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Technical Report

Light-Duty Alternative Fuel Vehicles: Federal Test Procedure Emissions Results

K. Kelly, L. Eudy, and T. Coburn

National Renewable Energy Laboratory

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Prepared under Task No. FU905010

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LIST OF ABBREVIATIONS

AFDC	Alternative Fuels Data Center
AFV	alternative fuel vehicle
AMFA	Alternative Motor Fuels Act of 1988
ANOVA	analysis of variance
AQIRP	Air Quality Improvement Research Program
Btu	British thermal unit
C_4H_6	chemical formula for 1,3-butadiene
C_6H_6	chemical formula for benzene
CH_3CHO	chemical formula for acetaldehyde
CH_4	chemical formula for methane
CNG	compressed natural gas
CO	carbon monoxide
CO_2	carbon dioxide
DOE	Department of Energy
E85	ethanol fuel (85% ethanol, 15% gasoline)
EPA	Environmental Protection Agency
EPAct	Energy Policy Act of 1992
FFV	flexible-fuel vehicle
FTP	Federal Test Procedure
gge	gallon gasoline equivalent
GSA	General Services Administration
HC	hydrocarbons
HCHO	chemical formula for formaldehyde
LEV	low-emission vehicle
M85	methanol fuel (85% methanol, 15% gasoline)
MIR	maximum incremental reactivity
mpeg	miles per equivalent gallon
NMHC	non-methane hydrocarbons
NMHCE	non-methane hydrocarbon equivalent
NMOG	non-methane organic gases
NO_x	oxides of nitrogen
NREL	National Renewable Energy Laboratory
OEM	original equipment manufacturer
OFP	ozone-forming potential
PWT	potency-weighted toxics
RFG	California Phase II reformulated gasoline
scf	standard cubic foot
SR	specific reactivity
THC	total hydrocarbons
TLEV	transitional low-emission vehicle
ULEV	ultra-low emission vehicle

EXECUTIVE SUMMARY

In 1988, the federal government enacted the Alternative Motor Fuels Act (AMFA) to encourage the development and use of methanol, ethanol, and natural gas as transportation fuels for consumers. This was followed by the Clean Air Act Amendments (CAAA) in 1990 and the Energy Policy Act (EPAct) in 1992. As part of AMFA and EPAct, the Department of Energy (DOE) is required to promote the use of alternative fuels to address environmental concerns and energy security. As a result of these federal actions and the lack of conclusive information on in-use emissions from alternative fuel vehicles (AFVs), DOE, through the National Renewable Energy Laboratory (NREL), conducted an extensive series of emissions tests on AFVs being used in the federal government fleet.

The goal of the NREL emissions testing program was to provide a high quality, objective assessment of the in-use emissions from commercially available AFVs. This report summarizes the results from 1,280 emissions tests performed on 413 vehicles between 1994 and 1997, including tests on methanol and ethanol flexible-fuel vehicles (FFVs), dedicated compressed natural gas (CNG) vehicles, and matching standard gasoline vehicles. Many vehicles were tested several times at approximately 1-year intervals. The data sets for each year are referred to as test "rounds." All tests followed the U.S. Environmental Protection Agency's (EPA) existing Federal Test Procedures (FTP-75) for emissions certification. Measurement of regulated emissions included non-methane hydrocarbons (NMHC), carbon monoxide (CO), oxides of nitrogen (NO_x), and evaporative hydrocarbons. Measurements of non-regulated emissions included formaldehyde (HCHO), acetaldehyde (CH_3CHO), carbon dioxide (CO_2), and methane (CH_4). The vehicles tested were original equipment manufacturer (OEM) models taken from the pool of vehicles used in the General Service Administration's (GSA) federal fleet. The testing was performed at private emissions laboratories in Ohio, Colorado, and Maryland. Each laboratory used the EPA's FTP-75 for exhaust emissions and evaporative emissions with test fuels that were blended specifically for this program. The gasoline fuel that was used for comparison was California Phase II reformulated gasoline (RFG). This fuel was chosen in order to make a comparison between alternative fuel emissions and a "best case" scenario for gasoline. One might expect that the comparison of emissions between alternative fuels and an industry average gasoline would be slightly more favorable for alternative fuels than the comparison in this report because RFG is a cleaner burning fuel than the industry average gasoline. Several vehicles were randomly selected for more extensive tests that included detailed analysis of the hydrocarbon emissions. The test results were used to assess differences in the composition of hydrocarbon emissions in terms of their relative toxicity and reactivity or propensity to form ozone in the atmosphere.

In general, this study found that fuel is an important factor in vehicle emissions. However, the study also shows that vehicle-to-vehicle variability is significant, and that engine and emissions controls system design and calibration are also critical factors. In other words, the fuel is important, but individual vehicle differences (resulting from, for example, manufacturing tolerances, vehicle service history, or duty cycle) and vehicle model design differences also play a major role in the measured emissions reductions.

A comparison of the regulated emissions from the FFVs tested on alcohol fuels and RFG tended to fall into one of two categories:

(1) Compared to RFG, the alcohol emissions showed a decrease for one or two of the regulated emissions constituents coupled with an increase in the other constituents, or

(2) There was no significant difference in the emissions from the two test fuels.

In both cases, the average results tended to be well within the applicable emissions standards. The lack of a clear benefit in regulated emissions for the alcohol tests may be a result of FFV design. FFVs are designed to meet customer performance and emissions certification requirements on any blend of alcohol and gasoline from 85% alcohol with 15% gasoline up to 100% gasoline. This design strategy allowed FFVs to be placed in the market with only a limited

alcohol refueling infrastructure, but it required compromises to be made in engine design and calibration. For example, FFVs cannot take advantage of the higher octane rating of alcohol fuel because they must be designed to accommodate the lowest octane rating of all possible fuel blends (i.e., 100% gasoline). Other studies have shown that more substantial emissions benefits can be achieved from a vehicle that has been optimized to run on a single blend of alcohol fuel[1].

Two areas where the alcohol fuel emissions did show clear advantages over RFG were in reducing the toxicity and the ozone-forming potential (OFP) of the hydrocarbon emissions. It could be expected that these benefits would be even more pronounced if a comparison were made to industry average gasoline, because RFG has been shown to reduce emissions of toxic constituents and be less reactive in forming ozone[2]. Tests on the alcohol fuels also showed a small but consistent reduction in CO_2 emissions compared to RFG tests.

Comparison of the average results from the CNG vehicles tended to be more straightforward. The dedicated CNG vehicles tested in this program exhibited significantly lower regulated emissions compared to similar gasoline vehicles tested on RFG. The toxicity and reactivity of the hydrocarbon emissions from CNG vehicles were also significantly lower.

The rapid development of emissions control technology continues, pushed by tougher regulations designed to help meet the National Ambient Air Quality Standards of the CAAA. The results presented here are representative of the alternative fuel technologies that were available during the study (1992 to 1995). More recent developments include both alternative fuel and gasoline vehicle designs that have been shown to meet more stringent emissions standards such as the state of California's ultra low-emission vehicle (ULEV) requirements. Dedicated CNG vehicles have recently been produced that advertise super-ULEV (or 1/10 below ULEV) capabilities. At the same time, auto manufacturers are producing bi-fuel CNG/gasoline vehicles that may run into similar design constraints as the FFVs (i.e., compromises are required to allow an engine to run on different fuels). Emissions certification tests have also evolved to address issues such as cold temperature emissions, emissions resulting from real-world or more aggressive driving behaviors, extended and running loss evaporative emissions, and emissions during operation of the vehicle's air conditioner. These changes may affect the comparison of emissions from alternative fuel to gasoline vehicles. The ability for AFVs to maintain emissions benefits at high mileage is also a question. Most of the AFVs in the federal fleet do not accumulate high mileage levels. Some of these issues are being addressed in other parts of this DOE/NREL program, and will be covered separately.

Summary of Results

Methanol

One-hundred and one M85 FFVs, including 1995 Dodge Intrepids and 1993 Dodge Spirits, were tested along with similar numbers of standard gasoline control vehicles. Most of the results from these vehicles were very consistent across vehicle models, test laboratories and test rounds. Non-methane hydrocarbon equivalent (NMHCE), CH_4, and CO_2 were significantly lower for the M85 tests than for the tests on RFG. Results for NO_x, CO, and evaporative emissions were not as consistent. Although CO emissions were slightly higher for one vehicle model and were lower for the other model tested, these results tended to be not statistically significant. NO_x results tended to be higher for the FFVs tested on M85 than when those same vehicles were tested on RFG. The evaporative emissions results for one vehicle model were consistently higher for the M85 tests; results for the other model were varied. Fuel economy for the M85 tests was significantly lower than the gasoline tests because of the lower energy content of the fuel, but was slightly higher when compared on an energy equivalent basis. Results for the more detailed tests show that both vehicle models tested on M85 emit significantly less potency-weighted toxics (PWT), and the OFP and specific reactivity is lower.

There are several possible reasons for finding mixed results and fuel effects that are not statistically significant for FFVs. One is that these vehicles are not optimized for either alcohol fuel or gasoline, but are designed to perform acceptably on a wide range of fuel blends. Another reason for varying results is calibration and hardware differences between vehicle models.

Ethanol

Forty-nine E85 FFVs, including the 1995 Ford Taurus and the 1993 Chevrolet Lumina, were tested along with similar numbers of standard gasoline control vehicles. The regulated emissions results for the two ethanol FFV models were not as consistent as the methanol results. In general, the regulated emissions from the FFV Taurus tested on E85 were not significantly different from emissions from the same vehicles tested on RFG. For the FFV Lumina, the NO_x emissions were significantly lower on E85, the CO emissions were significantly higher, and the hydrocarbon emissions were mixed

from round to round (total hydrocarbon and NMHCE). Non-regulated emissions for both vehicle models tested tended to be consistent, and the differences tended to be statistically significant. Average CO_2 was consistently lower when tested on E85 compared to RFG. Average aldehydes were consistently higher from the E85 test compared to the RFG tests.

When comparing the FFVs tested on E85 to the same vehicles tested on RFG, results of the detailed hydrocarbon analysis showed that average aldehyde emissions and OFP tended to be higher, while average 1,3-butadiene, benzene, total PWT, and specific reactivity tended to be significantly lower.

As with the methanol vehicles, the ethanol vehicles are flexible-fuel designs that are not optimized for either gasoline or ethanol. The differences in results between vehicle models and the lack of clear differences in regulated emission results may be due, in part, to engine hardware choices and calibrations that must be flexible to accommodate a wide range of fuel blends.

Compressed Natural Gas

In all, 67 dedicated CNG vehicles (1992/94 Dodge B250 vans and 1994 Dodge Caravans) were tested along with 69 similar gasoline control vehicles. Results for the CNG vehicles show that there tend to be statistically significant differences between the average emissions from the CNG and RFG tests, and that these results tend to be fairly consistent for both vehicle models from lab to lab and from round to round. The average NMHC, CO, CO_2, and acetaldehyde results were significantly lower from the CNG tests than from the RFG tests. Average CH_4 emissions were consistently higher from CNG than from RFG. NO_x and "evaporative" hydrocarbons tended to be lower from the CNG tests, but in some cases the differences were not significant. A modified "evaporative" emissions test was performed to measure the hydrocarbons emanating from the vehicles during two 1-hour soaks in a sealed enclosure with the engine off. Dedicated gaseous fuel vehicles typically do not have evaporative control systems because the fuel system is said to be "sealed" under pressure. Nevertheless, hydrocarbons (mostly methane) were found emanating from gaseous fuel vehicles. In all cases, the average total hydrocarbons measured during the CNG evaporative tests were lower than those from the RFG tests, but in a few cases the difference was not statistically significant. The fuel economy results for the CNG vehicles were lower than those of the gasoline vehicles. This was consistent for both models.

Results from the detailed analysis of hydrocarbon emissions were very consistent for the two labs where this analysis was performed. At both labs, the CNG emissions had lower average values of the four toxic emissions that were quantified, had lower PWT, lower average OFP and lower average specific reactivity. These differences were all deemed statistically significant at the 95% confidence level.

INTRODUCTION

For the past few years, the National Renewable Energy Laboratory (NREL) has managed a series of light-duty vehicle chassis dynamometer emissions tests on alternative fuel vehicles (AFVs) for the U.S. Department of Energy (DOE). These tests are part of a larger program to demonstrate the use of AFVs that was mandated by the Alternative Motor Fuels Act of 1988 (AMFA) and the Energy Policy Act of 1992 (EPAct). One of the major objectives of these legislative actions is to promote the use of alternative transportation fuels in order to address energy security and environmental issues. As part of the AMFA program, vehicle performance, operational costs, maintenance, and fuel economy data are also being collected by NREL's Alternative Fuels Utilization Program and disseminated through the Alternative Fuels Data Center (AFDC). This report is designed to present a detailed evaluation of the emissions test results collected in this program.

The principal phase of the AMFA test program was initiated in 1994. Its purpose was to determine relative emissions from AFVs compared to otherwise identical gasoline vehicles taken from actual service. Approximately 25 each of several AFV models from several locations (including high altitude) around the country were randomly selected for participation in this program. All vehicles were selected from those available in the U.S. federal fleet. Test vehicles were scheduled for emissions testing once per year. The test matrix of vehicles, locations, and mileage levels was statistically designed to optimize reliability of the data and to control variability in the emissions results.

In addition to testing all vehicles for regulated exhaust and evaporative emissions, we conducted a detailed speciation of the hydrocarbon (HC) emissions on a subset of the test vehicles. Speciation of the HC emissions allows for an evaluation of the relative level of air toxic emissions and the reactivity or ozone forming potential (OFP) of the HC. Additionally, we also tested a small number of vehicles using new or proposed chassis dynamometer driving cycles. These "off-cycle" emissions tests are still in progress and the results will be discussed in a later report.

A BACKGROUND ON VEHICLE EMISSIONS AND FUEL ECONOMY

As a result of fuel combustion, automobiles emit various compounds into the atmosphere in the form of exhaust. The U.S. Environmental Protection Agency (EPA) regulates some of these compounds; the amounts of the compounds that are emitted by vehicles cannot exceed certain levels. Other compounds, although not officially regulated, are important contributors to adverse atmospheric conditions such as ambient ozone and global climate change.

The emissions compounds regulated by the EPA include carbon monoxide (CO), oxides of nitrogen (NO_x), HC, and non-methane hydrocarbons (NMHC). Methane (CH_4) is not currently regulated because it is considered to be relatively non-reactive in forming ozone in the atmosphere. Exhaust from alcohol fuel vehicles also includes unburned alcohol and aldehydes, which are partial combustion products. For alcohol fuels, such as the ones investigated in this study, these compounds are regulated along with non-methane hydrocarbons as non-methane hydrocarbon equivalent (NMHCE). NMHCE is calculated by modifying the measured NMHC fraction to account for the alcohol and aldehyde emissions that are prevalent in emissions from alcohol fuels. More recent standards use non-methane organic gases (NMOG) as the regulated compound. NMOG is the sum of non-oxygenated and oxygenated HC in a gas sample. This includes all oxygenated organic gases with 5 or less carbon atoms (such as aldehydes, ketones, and alcohols) and all known alkanes, alkynes, alkenes, and aromatics with 12 or less carbon atoms.[3] The EPA's emissions standards applicable to the light-duty vehicles tested in this program are given in Table 1. Table 2 shows the EPA standards applicable to the heavy light-duty vehicles that were tested. EPA defines heavy light-duty vehicles as those with gross vehicular weight ratings between 6,000 and 8,500 lb.

Hydrocarbons can also escape from a vehicle through evaporation of the liquid fuel. Such evaporation occurs in several ways. Diurnal evaporative losses are emissions that occur during the day as the temperature rises.

Table 1. Intermediate Useful Life (5 years, 50,000 miles) Standards for Light-Duty Vehicles (g/mi)[4]

Fuel	Standard	THC	NMHC	NMOG	HCE	NMHCE	CO	NOx
Gasoline	Tier 0	0.41					3.4	1.0
Gasoline	Tier 1	0.41	0.25				3.4	0.4
Alcohol	Tier 0				0.41		3.4	1.0
Alcohol	Tier 1				0.41	0.25	3.4	0.4
	TLEV			0.125			3.4	0.4

Table 2. Intermediate Useful Life Standards for Heavy Light-Duty Vehicles (g/mi)[4]

Standard	THC	NMHC	CO	NOx
Tier 0 (120,000 mi full useful life)	0.80	0.67	10	1.7
Tier 1 (5-yr or 50,000 mi intermediate useful life)		0.32	4.4	0.7
Tier 1 (100,000 mi intermediate useful life)		0.4	5.5	0.97

As the fuel tank temperature increases, fuel evaporation increases and vapors are vented. Hot soak losses occur after the vehicle is turned off—the engine and fuel tank remains hot for a period of time, allowing further fuel evaporation. While the vehicle is running, the hot engine and exhaust system cause additional fuel to be vaporized. These emissions are called running loss emissions. Finally, during refueling, fuel vapors present in the tank are forced out as the tank is filled, resulting in refueling losses.[5] Since this test program began, the EPA has expanded its Federal Test Procedures for evaporative emissions to include procedures for each of the evaporative sources listed above. However, all the evaporative emissions results discussed in this report are from the previous EPA test procedures that were limited to two (one diurnal and one hot soak) 1-hour evaporative emissions tests.

Modern light-duty vehicles include evaporative control systems that contain and redirect much of the vaporized fuel back into the engine. One notable exception is compressed natural gas (CNG) vehicles. For vehicles designed to operate exclusively on CNG, the fuel remains in a gaseous state, and the entire fuel system is sealed under pressure. Therefore, a separate evaporative control system is not necessary for these vehicle types.

The non-regulated emissions evaluated in this study include carbon dioxide (CO_2), CH_4, and air toxics. CO_2 and CH_4 are greenhouse gases that trap the earth's heat and may contribute to global warming. Air toxics are pollutants that EPA classifies as known or probable human carcinogens—in other words, components considered to have adverse affects on human health. The air toxics evaluated in this study include benzene (C_6H_6), formaldehyde (HCHO), acetaldehyde (CH_3CHO), and 1,3-butadiene (C_4H_6). Benzene is a known carcinogen, and the latter three compounds are probable carcinogens.

Hydrocarbon emissions from vehicles may be made up of hundreds of individual hydrocarbon compounds or species. A gas chromatograph can be used to quantify the amounts of the individual HC species in a process known as detailed HC speciation. In this report, the speciation of hydrocarbon emissions is used to gain additional insight into HC emissions. Air toxics emissions are reported directly and as potency-weighted toxics (PWT). Potency weighting gives an indication of the relative level of risk for each of the toxic compounds emitted. The EPA has calculated an inhalation unit risk factor for each of the hazardous compounds. The weighting factor for each compound is determined by dividing its individual unit risk factor by the unit risk factor that is the highest of the four (in this case, 1,3-butadiene). The resulting number is multiplied by the mass emissions for the respective compound to calculate the PWT value. For example, acetaldehyde has a risk factor that is 127 times lower than 1,3-butadiene. The total PWT is the sum of the individual potency weighted values. These EPA risk factors are listed in Table 3.[6]

Results from the HC speciation are also used to evaluate the tendency for HC emissions to react in the atmosphere and form ozone. These results are reported here as OFP and specific reactivity (SR). Regulations in California assign a maximum incremental reactivity (MIR) value to individual compounds emitted in automobile exhaust. The MIR value is the predicted contribution of the compound to ozone formation in certain urban atmospheres, and is expressed in units of milligrams of

ozone formed per milligram of the compound emitted. The MIR value is determined in a laboratory experiment in which a small increment of the compound is added to a simulated urban background mixture and the net increase in ozone is measured. Taking into account the MIR values for all measured exhaust compounds, an OFP for the fuel in question may be calculated. Specific reactivity for a given fuel may also be calculated by combining the respective mass of compound emissions per mile with the OFP, which results in units of milligrams of ozone per milligram of total organic emissions. In California, SR is based on NMOG emissions. Specific reactivity is usually constant for a given fuel and engine technology. To clarify the difference between them, OFP gives an estimate of the amount of ozone formed per mile traveled; SR gives an estimate of the amount of ozone formed per gram of NMOG emitted. OFP and SR are relative numbers associated with particular atmospheric conditions.

Fuel economy is also calculated from the results of the emissions testing procedures. For vehicles tested on gasoline, fuel economy is reported in miles per gallon (mpg). For vehicles tested on alcohol fuels, fuel economy is expressed both as miles per gallon and miles per equivalent gallon (mpeg). The mpeg measurement gives an estimate of how far the vehicle can travel on an amount of fuel that has the same energy as a gallon of gasoline. Both are reported for alcohol tests because alcohol fuels have a lower volumetric energy content than gasoline. The energy content of the methanol test fuel (M85) is approximately 58% of gasoline; the energy content of the ethanol test fuel (E85) is approximately 73% of gasoline (M85 and E85 are further described below). For vehicles tested on CNG, fuel economy is reported only in miles per equivalent gallons.

Table 3. EPA Unit Risk Factors for Emissions Air Toxics

Compound	EPA Risk $(\mu g/m3)^{-1}$	EPA Factor (Normalized)
1,3-butadiene	2.8×10^{-4}	1.000
Benzene	8.3×10^{-6}	0.030
Formaldehyde	1.3×10^{-5}	0.046
Acetaldehyde	2.2×10^{-6}	0.008

This is used for CNG tests because CNG is stored in a compressed gaseous state, which is not typically measured in gallons. For transportation applications, CNG is often dispensed and priced per gasoline gallon equivalent.

Test Vehicles for the Study

This report presents emissions test results on a number of different vehicle models. Table 4 lists these vehicle models, along with the numbers of vehicles of each model that were tested, and the total numbers of tests that were performed on all vehicles of each model. For every AFV model tested, an equivalent number of vehicles of the corresponding standard gasoline model (controls) were also tested. Because many vehicles were tested more than once over the course of the program (at increased mileage levels) more tests than vehicles are reported in Table 4. Replicate tests were also conducted on some vehicles. All the vehicles discussed here are original equipment manufacturer (OEM) vehicles. The test vehicles include four passenger car models, one full-size passenger van, and one minivan.

In order to provide information on emissions deterioration over time, the vehicles were scheduled for testing approximately once per year. The first set of tests on a particular vehicle model was designated as "Round 1," the second set as "Round 2," and so forth.

Both alcohol-fueled and CNG-fueled AFVs were included in the testing program. The principal alcohol fuels of interest were M85 (a blend of 85% methanol and 15% gasoline) and E85 (a blend of 85% ethanol and 15% gasoline). The alcohol-fueled vehicles are flexible-fuel vehicles (FFVs), which means that they are capable of operating on unleaded gasoline, or any blend of the alcohol and gasoline up to 85% alcohol and 15% gasoline. All the CNG models included in this report are dedicated CNG vehicles, which means they are designed to operate on CNG only.

As noted above, all test vehicles included in this program were part of the federal vehicle pool leased to various government fleets by the General Services Administration (GSA). A relatively large number of vehicles were selected for testing to account for the high variability observed in emissions from vehicles pulled directly from fleet service. These differences may be caused by physical differences inherent in any manufacturing process, or because vehicle usage and care vary from driver to driver and fleet manager to fleet manager. For instance, vehicle service applications may vary from short delivery routes to highway driving, and the degree to which the preventive maintenance schedule is followed depends, to a certain extent, on the diligence of the fleet manager. For these and other reasons, vehicle-to-vehicle variability in emissions levels was expected to be fairly high, even at the outset of the testing program.

Table 4. Emissions Tests Completed

Vehicle Model	Model Year	Vehicle Type	Number of Vehicles Tested	Number of Tests
Methanol				
Dodge Intrepid	1995	M85 FFV	24	89
		Standard	25	47
Dodge Spirit	1993	M85 FFV	77	373
		Standard	72	145
Ethanol				
Ford Taurus	1994/95	E85 FV	24	88
	1995	Standard	24	45
Chevrolet Lumina	1992/93	E85 FFV	25	144
	1993	Standard	16	45
Compressed Natural Gas				
Dodge B-250	1992/94	Dedicated CNG	54	144
		Standard	53	138
Dodge Caravan	1994	Dedicated CNG	13	16
		Standard	6	6
Total			413	1,280

Test Facilities

All testing was performed at private commercial laboratories with chassis dynamometer exhaust and evaporative emission test equipment that is capable of performing EPA emissions certification test procedures. A detailed description of the type of test procedures and equipment used can be found on the AFDC Web site (http://www.afdc. doe.gov). The laboratories were selected on the basis of a federal government competitive bidding process in which experience with performing the Federal Test Procedures (FTP)—in particular, FTP testing of alcohol and natural gas vehicles—was stressed. Three organizations were awarded emissions testing subcontracts: Automotive Testing Laboratories (ATL) in East Liberty, Ohio, which tested vehicles from Ohio, Michigan, and Illinois; Environmental Research and Development (ERD), which tested vehicles in the Washington D.C. and New York City regions; and ManTech Environmental Technology, Inc. (ManTech), which tested vehicles from Colorado (at a high altitude of approximately 5,300 feet). For the remainder of the report, these labs are referred to as Lab 1, Lab 2, and Lab 3, respectively. Before any testing began, a coordination meeting was held between all the participating laboratories and NREL to ensure consistency in the test procedures. NREL and EPA employees subsequently conducted laboratory site visits.

Test Fuels

Table 5 summarizes the physical properties of the liquid test fuels used in this study. The baseline gasoline used was California Phase 2 reformulated gasoline, or RFG. This fuel was chosen because it represents a "best case" scenario for gasoline emissions. If alternative fuels are to compete, they must be compared to the best gasoline available. RFG has a lower sulfur, olefin, and aromatic content than standard unleaded gasoline. The Auto/Oil Air Quality Improvement Research Program (AQIRP) conducted extensive testing that compared emissions from vehicles tested on various fuel blends, including certification test fuel, industry-average gasoline, and RFG[2]. In general, the AQIRP study found that vehicles tested on RFG tended to show reduced regulated emissions. Therefore, one might expect that the comparison between alternative fuels and an industry-average gasoline would be slightly more favorable for alternative fuels than the results discussed here. The alcohol blends were prepared using 85% alcohol (methanol or ethanol) and 15% RFG. Phillips Petroleum Company blended and supplied the alcohol and gasoline fuels. Compressed Gas Technologies, Inc., supplied the CNG fuel that was designed to represent a national industry-average fuel composition.

Table 5. Liquid Fuel Properties

	M85	E85	RFG
Fuel Blend	**85% Methanol 15% RFG**	**85% Ethanol 15% RFG**	**100% RFG**
Specific Gravity	0.787	0.784	0.741
Carbon (wt %)	44.1	56.7	84.4
Hydrogen (wt %)	12.7	13.2	13.6
Oxygen (wt %)	43.1	30.1	2.0
Net Heat of Combustion (Btu/gal)	64,600	81,825	111,960
Reid Vapor Pressure	7.5	6.15	6.9

Table 6 lists the specifications and a sample analysis of the CNG fuel used throughout the study.

Table 6. Composition of CNG

	% Volume	
Component	**Specification**	**Analysis**
Methane	93.05	93.15
Ethane	3.47	3.52
Nitrogen	1.67	1.47
Carbon Dioxide	0.81	0.82
Propane	0.66	0.68
N-Butane	0.12	0.13
I-Butane	0.08	0.07
N-Hexane	0.06	0.06
I-Pentane	0.04	0.06
N-Pentane	0.03	0.04
Oxygen	0.00	0.00

Test Procedures

This program used the EPA's emissions certification test procedure, known as the FTP-75. The FTP-75 includes measurement of exhaust emissions on a chassis dynamometer and two 1-hour evaporative emissions tests. Details of the test procedures are described in the *Code of Federal Regulations*[4]. Once a vehicle was identified for testing, the laboratory notified the fleet representative and scheduled a convenient test date. The lab also verified that the vehicle had received all scheduled maintenance and was operating properly. On arrival at the test laboratory, the vehicle was inspected for any problems. Once the vehicle was approved for testing, it was subjected to an extensive procedure designed to minimize residual effects from resident fuels. Figure 1 outlines the complete procedure for testing a vehicle, including the fuel changeover procedure. The fuel changeover procedure was performed before every test, including the first test in the sequence. This process follows the AQIRP's vehicle testing procedures.[7] The main elements of the fuel changeover procedure are a 60-minute purge of the vehicle's evaporative canister, several fuel tank drain and fill sequences, a chassis dynamometer driving cycle using the test fuel, and several engine start-up and idle sequences. Another part of the vehicle preconditioning procedure is the Urban Dynamometer Driving Schedule (UDDS), also called the LA4. The UDDS was derived from an actual driving route through LA that was selected to represent a typical city driving pattern.

Once the fuel changeover procedure was complete, the vehicle was tested following the FTP-75 for light-duty vehicle chassis dynamometer testing (including evaporative testing). Figure 2 shows the FTP-75 driving cycle. Alcohol fuel vehicles were tested on both alcohol fuel (M85 or E85) and RFG. The corresponding control vehicles were tested on RFG. All CNG vehicles were tested only on CNG fuel, and their corresponding gasoline controls were tested on RFG.

The emissions samples collected during the FTP were analyzed for HC, CH_4, NO_x, CO, and CO_2. Alcohols (ethanol and methanol) in the emissions were collected using primary and secondary impingers. Gas chromatography was used to analyze the alcohols. Aldehydes were collected on dinitrophenylhydrazine (DNPH) coated silica cartridges or impingers filled with an acetonitrile/DNPH solution, and analyzed

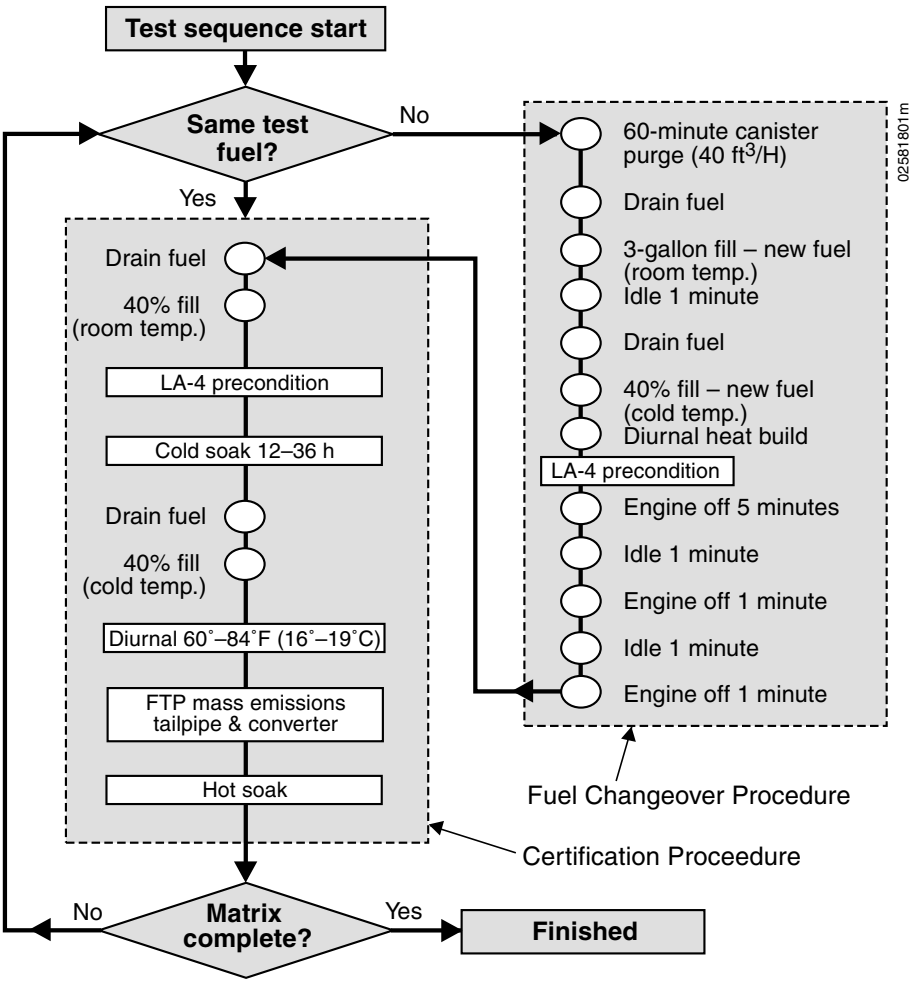


Figure 1. Vehicle testing procedure

using high-performance liquid chromatography. Appendix A contains the entire FTP data set.

The emissions from a subset of test vehicles were subjected to full hydrocarbon speciation. Speciation is the quantification of individual HC components using gas chromatography. Table 7 lists the numbers and types of vehicles for which hydrocarbon emissions were speciated. Up to 288 HC constituents in the emissions samples were identified; a complete list is given in Appendix B. Appendix C contains the speciated HC data set.

Data Analysis Approach

Raw data files of the emissions tests from each laboratory were electronically submitted and loaded into the AFDC at NREL. Before conducting any analyses of the data, a number of checks and edits were undertaken to ensure data quality. The data sets were sorted by vehicle model, test fuel, and test round. Repeat tests were reviewed for problems or outliers. In most cases, these duplicate tests were averaged and returned to the data set. Each data set was then analyzed for outliers, which were removed. Outliers were defined as any value that was +/- 3 standard deviations from the mean. An exception was made with the evaporative emissions results. Because of the high variability of evaporative data, no outliers were removed from the data sets.

After all checks and edits were applied, the data were imported into the JMP® software, which is a comprehensive PC-based statistical data analysis package developed by SAS Institute. Using this software, a multi-variable analysis of variance (ANOVA) was performed to determine the statistical significance of various factors on emissions. The primary effects of interest include fuel, vehicle, and test round. Secondary effects include the fuel by vehicle, fuel by test round, and vehicle by test round interactions. All data were analyzed at the 95% confidence level. Appendix D gives a detailed explanation of the data compilation and the ANOVA statistical approach.

Presentation of Analysis Results

The following sections contain discussions of the results from each of the individual vehicle models tested. Sections on each alternative fuel begin with an overview comparing the fuel with RFG, followed by details on each model. The discussions on each vehicle model are subdivided into sections on regulated emissions, evaporative emissions, greenhouse gases, and aldehydes. Separate tables and graphs cover the air toxics, OFP, and SR. Each of these sections concentrates on the comparison between the emissions and the EPA standard, fuel differences, and round-to-round differences.

The results are presented in tables that include regulated and non-regulated emissions constituents for each vehicle model. These tables contain descriptive statistics for emissions results obtained for each fuel on which the vehicle model was tested. Average emissions are reported as grams per mile. Of particular interest is the percent difference between the emissions from the alternative fuel and the RFG tests (e.g., M85 versus RFG).

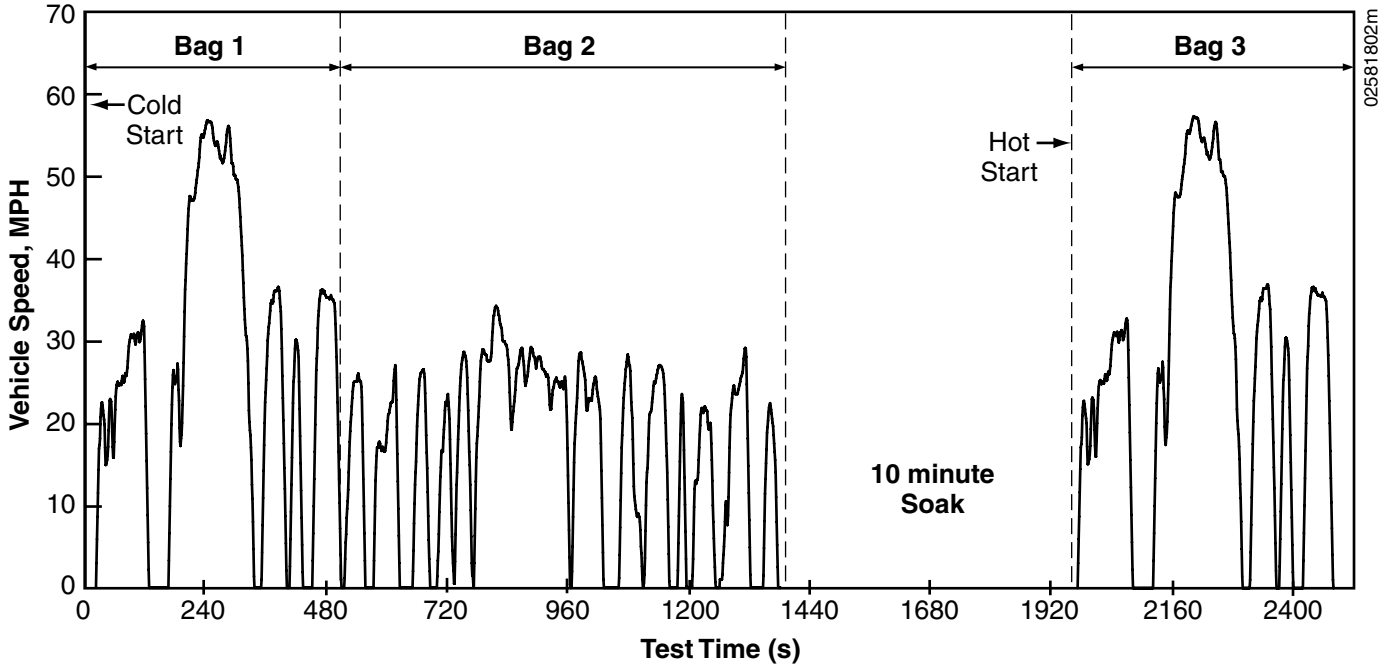


Figure 2. EPA's FTP-75 driving cycle

For each vehicle model tested, a summary table of results shows the average results, percent differences between the averages, and an indication of which differences in average values are statistically significant at the 95% confidence level. Percent difference was calculated using the following formula:

$$\frac{\overline{U_{AlternateFuel}} - \overline{U_{Gasoline}}}{\overline{U_{Gasoline}}} \times 100,$$

where $\overline{U}$ is the average of emissions test results obtained on the fuel in question. Statistical significance was determined through ANOVA procedures, applying the appropriate data model for each particular case. An example ANOVA table is shown in Appendix D.

In addition to the tables, each section contains a series of graphs depicting the average emissions results (by fuel, lab, and/or round) for the different fuels tested. Bar charts or line graphs are used to illustrate the differences between fuels. The text accompanying the tables and graphs describes the various trends depicted in them, and discusses the statistical significance (if any) of those trends.

For the alcohol-fuel vehicle models, the comparisons discussed concentrate on the difference between the alcohol and the gasoline tests on the FFV. This eliminates any discrepancies in the results that could result from large differences in odometer readings for the FFV and gasoline control vehicles. The results for the gasoline control model are shown in the graphs for reference. Because the CNG vehicles are dedicated vehicles, the comparison must be made between the AFV and the gasoline control. Odometer range differences between these vehicles could play a part in the test results.

Table 7. Number and Type of Vehicles with HC Speciation

Model	Fuel	Type	Number of Vehicles	Number of Tests
Dodge Intrepid	M85	FFV	6	16
	RFG	Standard	4	7
Dodge Spirit	M85	FFV	10	28
	RFG	Standard	9	14
Ford Taurus	E85	FFV	6	16
	RFG	Standard	5	8
Dodge B250	CNG	Dedicated CNG	8	17
	RFG	Standard	8	16
Total			56	122

METHANOL VEHICLES

For this study, three different M85 FFV models were tested: the Dodge Spirit, the Dodge Intrepid, and the Ford Econoline van. Because the results for the Ford van were reported in a previous publication,[8] they are not included in this report.

Table 8 provides a summary comparison of the emissions from the FFVs tested on M85 to the same vehicles tested on RFG. In the table, the highlighted blocks indicate that there was a 95% statistically significant difference (based on the ANOVA) in emissions from the two fuels tested. A plus sign in the block means that the emissions from the M85 test were higher than those from the RFG test, and a minus sign means that the M85 emissions were lower. These results are shown for all of the measured emissions from the Dodge Spirit and the Intrepid at the respective test laboratories. For instance, during the first round (Round 1) of testing, the CO emissions from the Dodge Intrepid were higher for M85 than RFG (plus sign), but the difference was not statistically significant at the 95% confidence level (not highlighted). A more detailed and quantitative discussion of the specific results for each vehicle is presented in the following sections, but it may also be useful to consider a more qualitative view of the general trends for the methanol tests.

Some of the results (such as HC, greenhouse gases, aldehydes, and the fuel economy calculation) were very consistent across vehicle models, test laboratories and test rounds, others (CO, NO_x, and evaporative HC) were more mixed. Although both vehicle models are FFVs produced by Dodge, the two models may employ different engine calibrations in order to meet differing performance and emissions expectations.

In general, both vehicles tended to have significantly (evaluated at 95%) lower NMHCE, total hydrocarbon (THC), CO_2, CH_4, and CH_3CHO emissions, as well as lower fuel economy, when tested on M85. On the other hand, both vehicles tended to have significantly higher HCHO emissions and energy equivalent fuel economy (mpeg) when tested on M85. There appeared to be very little difference (not statistically significant at 95%) in CO and evaporative HC emissions between the two fuels. The NO_x emissions tended to be higher

Table 8. Summary Comparison of Average Emission Results from M85 versus RFG

	Dodge Intrepid Lab 1		Dodge Spirit Lab 1		Dodge Spirit Lab 3	
	Round 1	Round 2	Round 1	Round 2	Round 1	Round 2
Regulated Emissions						
NMHCE	-	-	-	-	-	-
THC	-	-	-	-	-	-
CO	+	+	-	-	-	-
NO_x	+	+	+	-	+	+
Evaporative Emissions						
THC	+	+	-	-	-	+
Greenhouse Gases						
CO_2	-	-	-	-	-	-
CH_4	-	-	-	-	-	-
Aldehydes						
HCHO	+	+	+	+	+	+
CH_3CHO	-	-	-	-	-	-
Fuel Economy						
mpg	-	-	-	-	-	-
mpeg	+	+	+	+	-	+

"+" Indicates results from M85 tests were higher than RFG tests
"-" Indicates results from M85 tests were lower than RFG tests
Highlighted blocks indicate a significant statistical difference.

from M85, but this result was not consistent across all test categories.

One possible reason for finding mixed results and fuel effects that are not statistically significant is that a FFV is not optimized for either fuel, but is instead designed to perform acceptably on a wide range of fuel blends. An inherent benefit of the flexible fuel design is the capability for convenient fueling on gasoline or methanol where it is available. An inherent drawback to this design is that the vehicle cannot be optimized to take advantage of some of the beneficial properties of methanol. One obvious example of this is that these vehicles are designed with a compression ratio that is suitable for gasoline. A vehicle optimized for methanol could be designed with an increased compression ratio that would take advantage of methanol's higher octane rating and provide increased power and efficiency.

A similar evaluation of the general trends from the more limited set of HC speciation tests (shown in Table 9) is very consistent across vehicles and labs. These results give an indication of how the chemical composition of the hydrocarbon emissions differ between the two fuels. With regard to the four air toxic HC covered here, the vehicles tested on M85 tended to emit much higher levels of HCHO, and significantly lower levels of CH_3CHO, 1,3-butadiene, and benzene compared to the same vehicles tested on RFG. When the potency weighting factors are applied to these emissions levels and totaled as the total PWT emissions, the M85 results were significantly lower than the RFG results.

Table 9. Summary Comparison of Average Speciated Hydrocarbon Results from M85 versus RFG

	Intrepid	Spirit	
Air Toxics	**Lab 1**	**Lab 1**	**Lab 3**
HCHO	+	+	+
CH_3CHO	-	-	-
1,3-butadiene	-	-	-
Benzene	-	-	-
Total PWT	-	-	-
Ozone Reactivity			
OFP	-	-	-
SR	-	-	-

"+" Indicates results from M85 tests were higher than RFG tests
"-" Indicates results from M85 tests were lower than RFG tests
Highlighted blocks indicate a significant statistical difference.

The detailed speciation of the HC was also used to compare the tendency for HC emissions to react and form ozone. The OFP and the SR of the HC emissions from the M85 tests were significantly lower than those from the same vehicles tested on RFG. The detailed evaluation of hydrocarbon emissions from M85 and RFG was consistent for both the toxic emissions and the parameters related to ozone formation for both vehicle models at the two laboratories that performed hydrocarbon speciation.

Argonne National Laboratory/PIX0

Figure 3. 1995 Dodge Intrepid

Dodge Intrepid

The 1995 Dodge Intrepid (shown in Figure 3) is a passenger car equipped with a 3.3 L V6 engine. This vehicle model employs electronically controlled multi-point fuel injection and is equipped with a three-way catalyst for exhaust emissions control. The flexible-fuel version was certified to the EPA federal Tier 0 emissions standard and the standard gasoline version was certified to federal Tier 1 levels (refer to Table 1, page 2). We performed two rounds of tests on the Dodge Intrepids at Lab 1. There were 17 standard gasoline Intrepids and 16 FFVs tested in both rounds. Mileage ranges and average

Table 10. Odometer Readings for the Dodge Intrepid

	FFV		Gasoline	
Round	1	2	1	2
No. vehicles tested	16	16	17	17
Odometer (miles)				
Average	5,128	14,332	5,661	17,231
Maximum	9,558	26,084	18,783	42,738
Minimum	3,047	9,653	3,336	5,929

odometer readings for the Intrepids are shown in Table 10. The complete listing of the vehicles tested and the detailed emissions test results are included in Appendix A.

Regulated Emissions

Table 11 shows the average emissions results for the Dodge Intrepid. The values shown include the averages for the FFV model tested on M85 and RFG and the percent difference between the averages. An indication is also given on whether the difference between the average results is statistically significant as determined by the ANOVA. All average regulated emissions shown here were well below the Tier 1 emissions standards. Figure 4 shows the regulated and CO_2 emissions for the Intrepid along with the Tier 1 50,000-mile certification standard. In general, when comparing the M85 and RFG regulated emissions for the FFV Dodge Intrepid, NMHCE emissions from the M85 tests were lower, there was very little difference in CO emissions, and the NO_x emissions from the M85 tests were substantially higher.

More specifically, the FFV Intrepid showed a statistically significant decrease in HC emissions when tested on M85. In Round 1, the average emissions from the M85 tests were 16% lower; in Round 2, they were 19.6% lower than those from the same vehicles tested on RFG. When comparing the FFV tested on RFG to the standard Intrepid, the FFV had higher NMHCE emissions in both test rounds. For the FFVs, there tended to be a small, but statistically significant increase in NMHCE emissions from Round 1 to Round 2.

Table 11. Average Emissions Results from the Dodge Intrepid

	Round 1				Round 2			
	FFV-M85	FFV-RFG	Percent Difference	Sig. Fuel Effect?	FFV-M85	FFV-RFG	Percent Difference	Sig. Fuel Effect?
Regulated Emissions (g/mi)								
NMHCE	0.107	0.127	-15.7%	y	0.127	0.158	-19.62%	y
THC	0.112	0.149	-24.7%	y	0.132	0.182	-27.6%	y
CO	1.01	0.99	2.0%	n	1.16	1.12	3.9%	n
NO_x	0.328	0.245	33.9%	y	0.283	0.239	18.2%	y
Evaporative Emissions (g/Test)								
Total Evaporative	0.876	0.669	30.9%	y	0.816	0.712	14.6%	n
Greenhouse Gases (g/mi)								
CO_2	413.9	452.3	-8.5%	y	395.0	431.2	-8.4%	y
CH_4	0.016	0.028	-42.7%	y	0.017	0.031	-43.6%	y
Aldehydes (mg/mi)								
HCHO	16.0	1.9	742.1%	y	17.62	2.52	604.8%	y
CH_3CHO	0.17	0.45	-62.0%	y	0.23	0.59	-60.9%	y
Fuel Economy								
mpg	11.66	19.19	-39.2%	y	12.16	20.13	-39.6%	y
mpeg	20.21	19.19	5.3%	y	21.07	20.13	4.7%	y

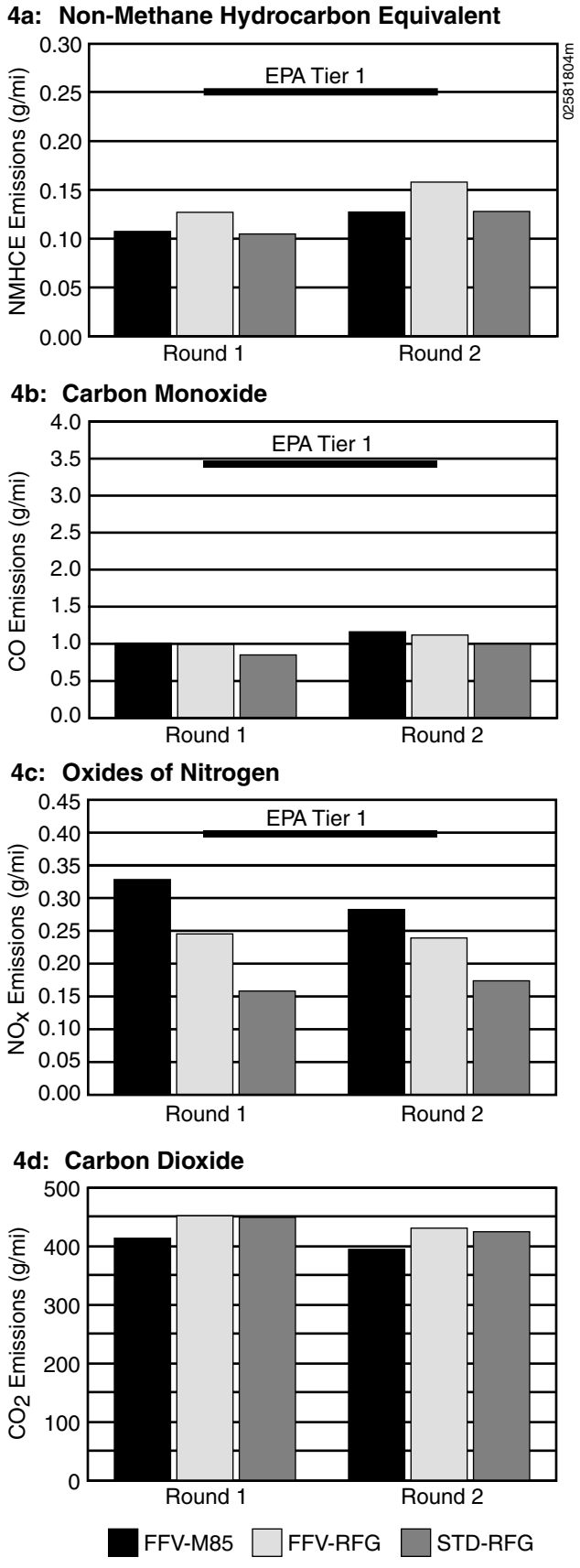


Figure 4. Emissions results from the Dodge Intrepid

The CO and NO_x emissions do not show the same trend as NMHCE. The CO emissions from the FFVs tested on M85 were not statistically different from the results of the FFVs tested on RFG and there was little difference between rounds. There was a statistically significant increase in NO_x emissions for the FFV tested on M85. In Round 1, the NO_x emissions from the M85 tests were 33.9% higher; in Round 2, they were 18.2% higher than those from the RFG tests on the same vehicles. The NO_x emissions for the FFV Intrepid show a decrease in the second round that was significant for M85, but was not statistically significant for RFG. NO_x emissions from the standard gasoline vehicles tested on RFG were substantially lower than those from the FFVs tested on the same fuel.

Evaporative Emissions

The average evaporative emissions for the FFV Intrepid are listed in Table 11 and shown graphically in Figure 5. The average evaporative HC were well below the 2-g standard for the FFVs and the gasoline vehicles. When comparing evaporative emissions results for the FFV Intrepid tested on M85 to the same vehicles tested on RFG, the M85 evaporative emissions were 30% higher in Round 1, and 14.6% higher in Round 2. The higher evaporative emissions for the FFV tested on M85 is expected, because the Reid vapor pressure (RVP) of the methanol fuel is higher than that of RFG (see Table 5). The difference in evaporative emissions was statistically significant in Round 1, but was not in Round 2. The average evaporative emissions for the conventional Intrepids were lower than the averages for the FFV on both fuels. There was no significant difference between Round 1 and 2 for the FFV on either fuel.

Greenhouse Gases

The average CO_2 emissions for the Intrepids are listed in Table 11 and shown in Figure 4d. Results from Rounds 1 and 2

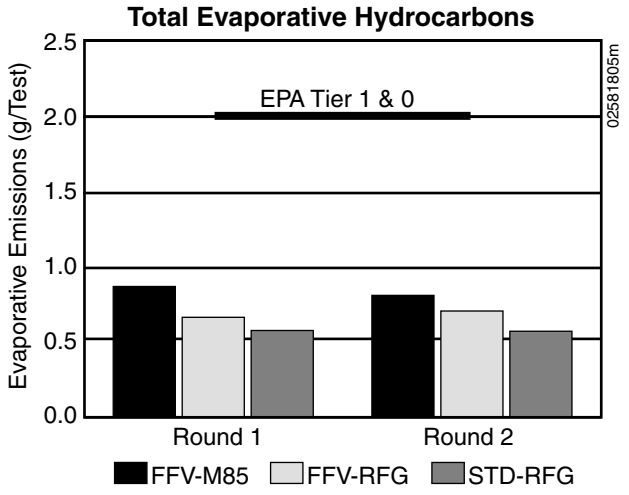


Figure 5. Evaporative emissions results from the Dodge Intrepid

followed the same trend between the fuels and vehicle types, with very little difference between the rounds. The CO_2 emissions from the FFV tested on M85 were approximately 8.5% lower than those from the same vehicles tested on RFG. The results for the standard model were similar to the FFV on RFG. Average CH_4 emissions were very low (less than 0.05 g/mi). For the FFV tested on M85, the CH_4 emissions were approximately 43% lower than those from the FFV tested on RFG in both rounds.

Aldehydes

Figure 6 shows the comparison of aldehyde emissions for the Dodge Intrepid. This graph shows that the formaldehyde emissions were much higher from the FFV when tested on M85. Formaldehyde is a primary decomposition product from methanol combustion; therefore, the higher numbers are expected. For Round 1, average formaldehyde emissions were 742% higher in the M85 tests, and for Round 2, the M85 results were 605% higher than the RFG results. Acetaldehyde emission levels for the FFV tested on M85 were approximately 61% lower than the results for the same vehicles tested on RFG, but the levels of acetaldehyde emissions were very low (less than 0.6 mg/mi).

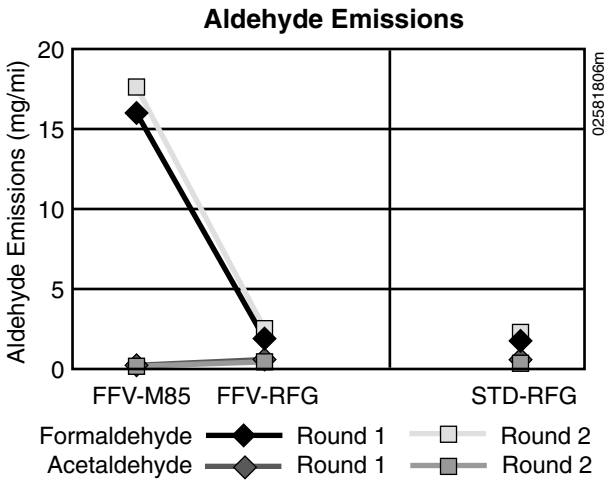


Figure 6. Aldehyde emissions from the Dodge Intrepid

Potency-Weighted Toxics and Ozone-Forming Potential

Over the two rounds of emissions tests performed, full HC speciation was performed on a total of six FFV Intrepids and four standard gasoline vehicles. Table 12 lists the average measured toxic emissions and the PWT values and percent difference for the four air toxic compounds. The potency weighting is discussed on page 2 and the factors are shown in Table 3. The aldehyde values listed are the averages for the speciated vehicles only. Figure 7 shows the comparison of these compounds and the total PWT for the Dodge Intrepids. When comparing PWT for the FFV Dodge Intrepids tested on M85 compared to the same vehicles tested on RFG, the HCHO emissions were significantly higher, but CH_3CHO, 1,3-butadiene, and benzene were significantly lower when tested on M85. Total PWT emissions for the FFVs tested on M85 were 16.2% lower than those from the same vehicles tested on RFG.

Table 13 lists the average OFP and SR for the FFV Intrepid. Figure 8 illustrates an important consideration when comparing HC emissions for the two test fuels. Both OFP and SR were significantly lower for the FFV when tested on M85. Although the average NMOG emissions from the M85 tests were 85% higher than the RFG tests, the OFP was 33.7% lower and the SR was 65.2% lower for the M85 tests. In other words, although the NMOG emissions from this subset of vehicles were higher, the potential to form ozone based on the exhaust composition is significantly lower. The exhaust from M85 is less reactive in forming ozone in the

Table 12. Toxic Emissions from the Dodge Intrepid

	FFV-M85		FFV-RFG		Percent Difference	Sig. Fuel Effect?
	Measured Value (mg/mi)	PWT	Measured Value (mg/mi)	PWT		
HCHO	15.65	0.72	2.00	0.092	682.5%	y
CH_3CHO	0.20	0.0016	0.488	0.0039	-59.0%	y
1,3-butadiene	0.113	0.113	0.813	0.813	-86.2%	y
Benzene	0.919	0.028	3.956	0.119	-76.8%	y
Total	16.882	0.861	7.257	1.027	-16.2%	y

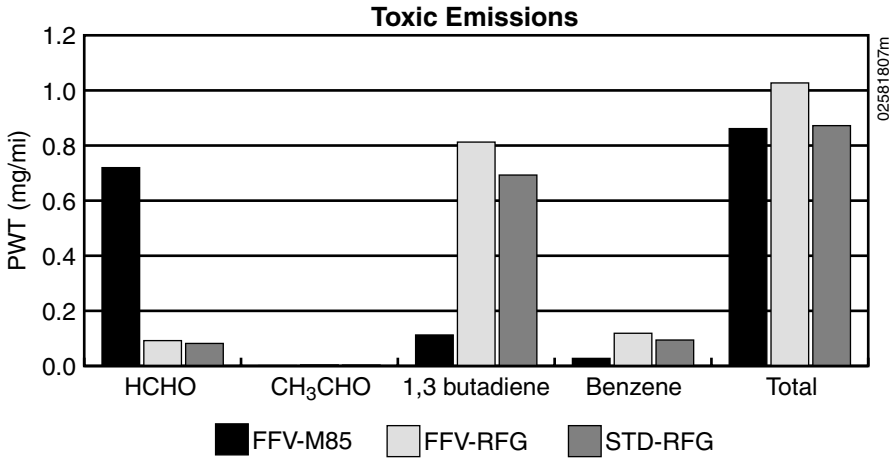


Figure 7. PWT emissions from the Dodge Intrepid

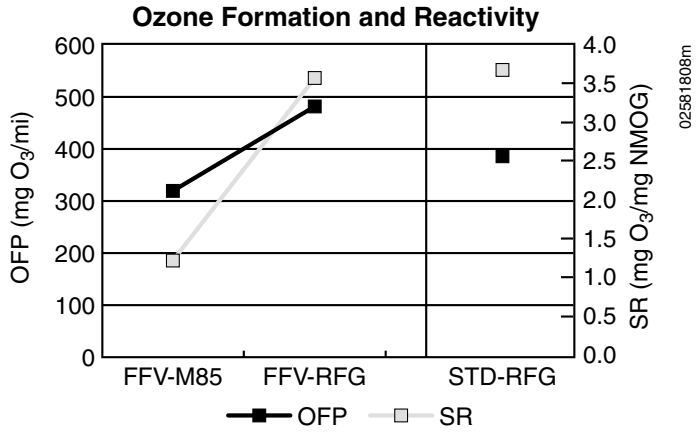


Figure 8. OFP and SR for the Dodge Intrepid

Table 13. OFP for the Dodge Intrepid

	FFV-M85	FFV-RFG	Percent Difference	Sig. Fuel Effect?
NMOG (mg/mi)	257.94	139.76	84.6	y
OFP (mg O_3/mi)	319.5	481.69	-33.7%	y
SR (mg O_3/mg NMOG)	1.248	3.587	-65.2%	y

atmosphere. The OFP and the SR for the gasoline model tested on RFG were similar to those of the FFV tested on RFG.

Fuel Economy

The fuel economy for the FFV Intrepid was approximately 12 mpg when operating on M85 and 20 mpg on gasoline. This is a decrease of approximately 39% for the FFV tested on M85 for both rounds. This is expected because methanol has a lower volumetric energy content than gasoline. The energy content of the M85 (64,600 Btu/gal) is 58% of the RFG (111,960 Btu/gal). In other words, it takes approximately 1.7 gallons of M85 to travel the same distance as 1 gallon of gasoline. When the values are adjusted to account for this difference, the average fuel economy for the FFV Intrepid on M85 is 20 mpeg in Round 1 and 21 mpeg in Round 2. In other words, the M85 tests showed a 5% improvement in energy equivalent fuel economy over RFG for Round 1 and a 4.7% improvement for Round 2. The FFV on gasoline had similar fuel economy numbers to the conventional model. An important consideration for most drivers is the range of the vehicle. Because of the difference in energy content of the fuels, the FFV operating on M85 will not travel as far as when using gasoline. For this reason, many manufacturers increase the size of the tank to help offset this difference. The FFV Intrepid and the gasoline control Intrepid tested here, however, both had 18-gallon fuel tanks. Based on the fuel economy for the FTP-75, the gasoline control vehicle has an approximate range of 356 miles; the FFV has a range of 214 miles on M85 and 354 miles on gasoline.

DODGE SPIRIT

The 1993 Dodge Spirit (shown in Figure 9) is a passenger car equipped with a 2.5 L, I6 engine with multipoint fuel injection. Although both the FFV and gasoline Spirits were certified to federal Tier 0 emissions standards, the majority of the emissions results are below the more stringent Tier 1 levels. This report covers the two rounds of testing performed on the Dodge Spirits at Labs 1 and 3. Lab 2 tested the Dodge Spirit in only 1 round and the results can be found in a previous publication.[8] At Lab 1, 21 FFV Spirits and 24 gasoline controls were tested in both rounds. At Lab 3, the FFV Spirits totaled 22 and the gasoline controls 20 in both rounds. Mileage ranges and average odometer readings for each vehicle type and round are listed in Tables 14 and 15. The complete data set can be found in Appendix A.

Warren Gretz, NREL/PIX02481

Figure 9. The 1993 M85 Dodge Spirit

Table 14. Odometer Readings for the Dodge Spirit Tested at Lab 1

	FFV		Gasoline	
Round	1	2	1	2
No. vehicles tested	21	21	24	24
Odometer (miles)				
Average	8,803	17,073	12,208	27,834
Maximum	18,203	29,679	35,757	61,638
Minimum	3,704	7,683	4,339	10,036

Table 15. Odometer Readings for the Dodge Spirit Tested at Lab 3

	FFV		Gasoline	
Round	1	2	1	2
No. vehicles tested	22	22	20	20
Odometer (miles)				
Average	14,030	24,240	16,063	28,035
Maximum	26,058	38,506	28,005	47,989
Minimum	4,080	8,746	5,743	9,467

Regulated Emissions

Tables 16 and 17 list the average emissions results for the FFV Dodge Spirits tested at Lab 1 and Lab 3. Included in the tables are the averages for the FFV tested on M85 and RFG, along with the percent difference between the averages. The statistical significance of the fuel effect was determined using the ANOVA analysis. All average regulated emissions for the Spirits tested at both labs were well below the Tier 0 emission standard and in most cases, also below the more stringent Tier 1 levels. (The EPA emissions certification standards are shown in Table 1 on page 2.) Figures 10 and 11 show the regulated and CO_2 emissions for the Spirits tested at Labs 1 and 3. In general, when comparing the regulated emissions for M85 and RFG tests for the Dodge Spirit, NMHCE emissions from the M85 tests were lower, CO emissions from the M85 tests were slightly lower, and NO_x emissions for the M85 tests tended to be higher.

Average HC emissions showed similar patterns on the vehicles tested at both labs. The NMHCE emissions for the FFV operating on M85 were significantly less than those from the same vehicles tested on gasoline (Figures 10a and 11a). For Lab 1, the difference was 17% during Round 1 and 27% in Round 2. For Lab 3, the difference between the fuels was even larger, approximately 30.5% in both rounds. NMHCE emissions for the conventional Spirits tested at both labs were lower than the levels of the FFV operating on either fuel. The difference in NMHCE emissions from Round 1 to Round 2 tended to be not significant at the 95% confidence level.

The CO emissions from both labs are shown in Figures 10b and 11b. The average values at Lab 3 were higher than the averages at Lab 1, but they follow the same pattern. At both labs the standard gasoline model had lower CO emissions than the FFV on either fuel. The FFV had lower CO emissions when tested on M85, but the difference between the two fuels was only significant for Round 2 at Lab 1. At Lab 1, the FFV on M85 was 1% lower in Round 1 and approximately 11% lower in Round 2. The FFVs tested at Lab 3 showed a difference of approximately 10% lower on M85 for both rounds. Average CO emissions showed increases from Round 1 to Round 2 that were statistically significant for both fuels at both labs. All CO emissions averages were well below the Tier 0 and Tier 1 standard of 3.4 g/mi.

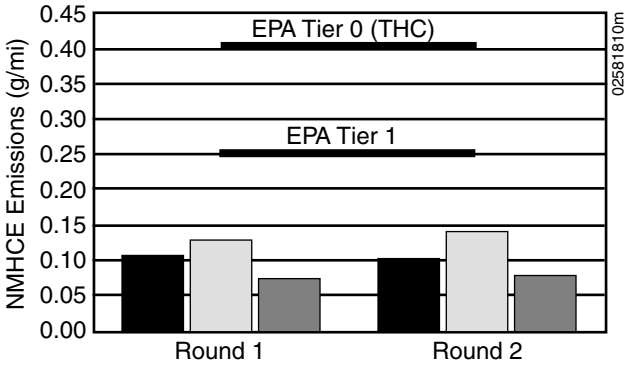
Table 16. Average Emissions Results from the Dodge Spirit Tested at Lab 1

	Round 1				Round 2			
	FFV-M85	FFV-RFG	Percent Difference	Sig. Fuel Effect?	FFV-M85	FFV-RFG	Percent Difference	Sig. Fuel Effect?
Regulated Emissions (g/mi)								
NMHCE	0.108	0.130	-16.9%	y	0.104	0.142	-26.9%	y
THC	0.112	0.151	-25.8%	y	0.111	0.168	-33.8%	y
CO	1.43	1.45	-1.2%	n	1.61	1.81	-10.9%	y
NO_x	0.212	0.151	40.4%	y	0.182	0.219	-16.9%	y
Evaporative Emissions (g/Test)								
Total Evaporative	0.708	0.724	-2.21%	n	0.78	0.887	-12.1%	n
Greenhouse Gases (g/mi)								
CO_2	350.3	379.5	-7.7%	y	348.6	376.8	-7.5%	y
CH_4	0.015	0.026	-43.1%	y	0.016	0.031	-49.8%	y
Aldehydes (mg/mi)								
HCHO	12.7	1.47	763.9%	y	12.4	1.42	771.8%	y
CH_3CHO	0.31	0.50	-37.8%	y	0.19	0.39	-50.9	y
Fuel Economy								
mpg	13.56	22.82	-40.6%	y	13.8	23.02	-40.1%	y
mpeg	23.5	22.82	3.0%	y	23.92	23.02	3.9%	y

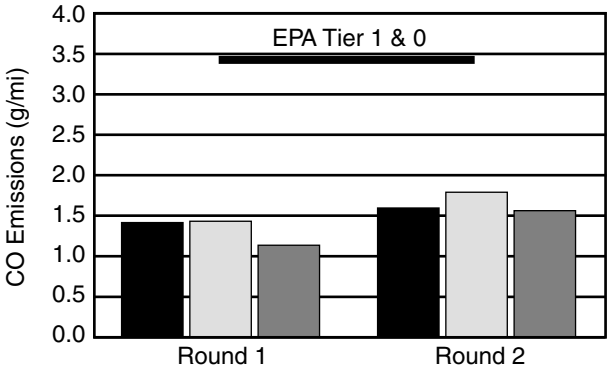
Table 17. Average Emissions Results from the Dodge Spirit Tested at Lab 3

	Round 1				Round 2			
	FFV-M85	FFV-RFG	Percent Difference	Sig. Fuel Effect?	FFV-M85	FFV-RFG	Percent Difference	Sig. Fuel Effect?
NMHCE	0.113	0.162	-30.6%	y	0.128	0.184	-30.4%	y
THC	0.061	0.188	-67.5%	y	0.061	0.220	-72.5%	y
CO	1.63	1.80	-9.6%	n	1.98	2.11	-10.5%	n
NO_x	0.207	0.166	24.7%	y	0.251	0.236	6.4%	n
Evaporative Emissions (g/Test)								
Total Evaporative	0.371	0.48	-22.7%	n	1.207	1.067	13.1%	n
Greenhouse Gases (g/mi)								
CO_2	331.3	357.2	-7.3%	y	331.5	357.9	-7.4%	y
CH_4	0.014	0.028	-48.5%	y	0.015	0.031	-52.0%	y
Aldehydes (mg/mi)								
HCHO	9.15	1.16	688.8%	y	10.4	1.63	538.0%	y
CH_3CHO	0.19	0.35	-45.7%	y	0.29	0.47	-38.3%	y
Fuel Economy								
mpg	12.78	24.07	-46.9%	y	14.46	24.0	-39.8%	y
mpeg	22.15	24.07	-8.0%	y	25.06	24.0	4.4%	y

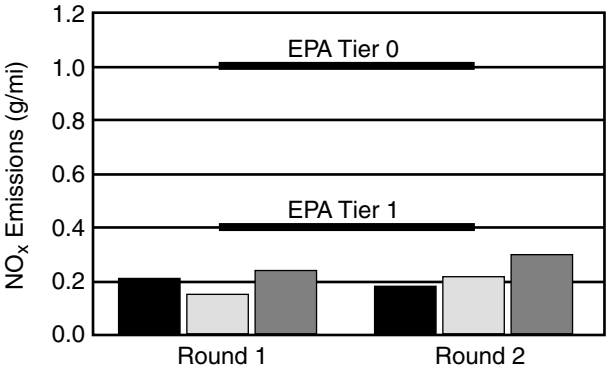
10a: Non-Methane Hydrocarbon Equivalent



10b: Carbon Monoxide



10c: Oxides of Nitrogen



10d: Carbon Dioxide

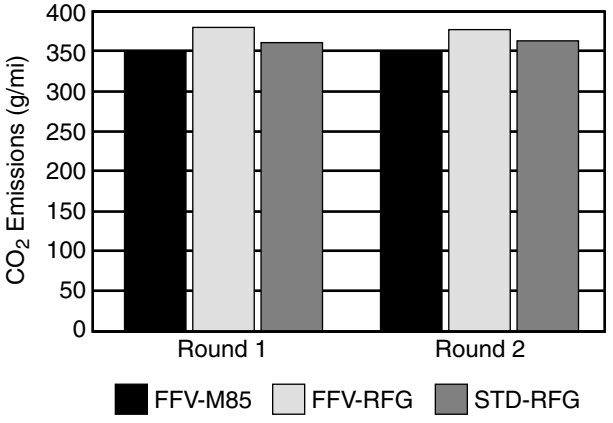
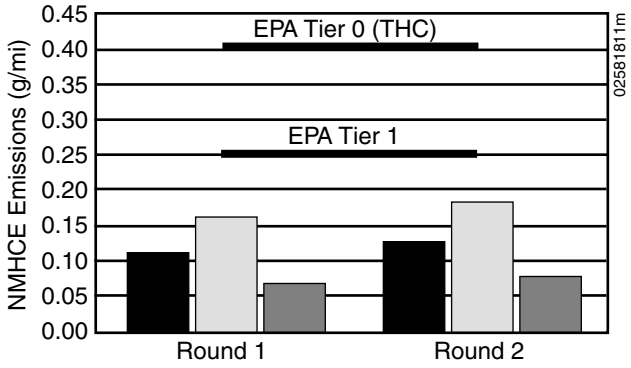
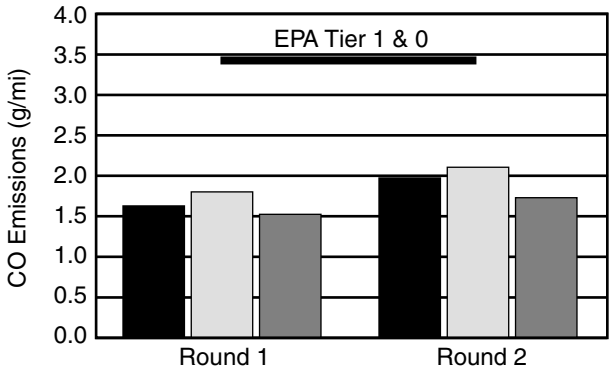


Figure 10. Emissions results from the Dodge Spirit tested at Lab 1

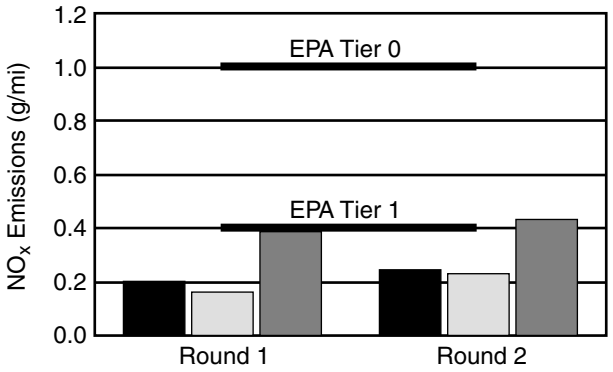
11a: Non-Methane Hydrocarbon Equivalent



11b: Carbon Monoxide



11c: Oxides of Nitrogen



11d: Carbon Dioxide

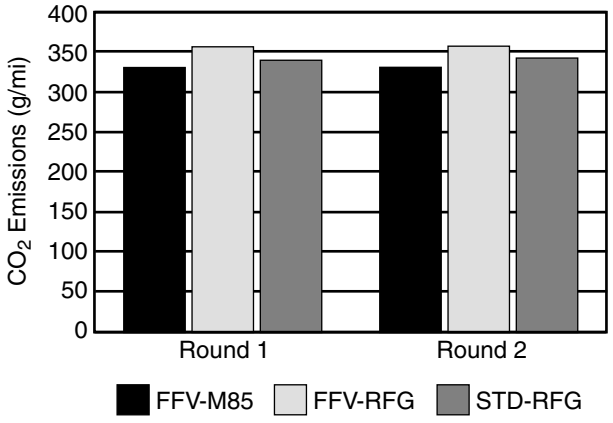


Figure 11. Emissions results from the Dodge Spirit tested at Lab 3

The NO_x emissions for the Spirits tested at Lab 1 showed different patterns in the two rounds. During Round 1, the NO_x emissions from the FFV operating on M85 were 40% higher than those from the same vehicles tested on RFG. The standard model tested on RFG had an even higher NO_x average. In Round 2, the average NO_x emissions for the FFV tested on M85 were 17% lower than the average when tested on RFG. The standard model again tested higher than the FFV on both fuels. The Spirits tested at Lab 3 showed similar trends. In Round 1, the FFV Spirits tested on M85 had 25% higher NO_x emissions than when they were tested on RFG. In Round 2, the average for M85 was only 6% higher than the average for RFG. The values for the standard model Spirits were much higher than the FFV Spirits in both rounds. All NO_x values were well below the Tier 0 levels.

Evaporative Emissions

Average evaporative emissions for the Dodge Spirits are listed in Tables 16 and 17. Figures 12 and 13 graphically illustrate these values. The average evaporative HC for the FFV and standard gasoline Spirits were well below the standard of 2 g per test. When comparing the FFV Spirits tested on M85 to the same vehicles tested on RFG, both labs showed no significant difference between the two fuels. The conventional Spirits tested lower than the FFV Spirits on either fuel with one exception. At Lab 3 during Round 1, the conventional Spirits had higher evaporative emissions than the FFV. There was an increase in evaporative emissions between Rounds 1 and 2 for the FFV tested on both fuels at Lab 1, but the difference was not significant at the 95% confidence level. At Lab 3, the FFV on both fuels showed statistically significant increases in Round 2.

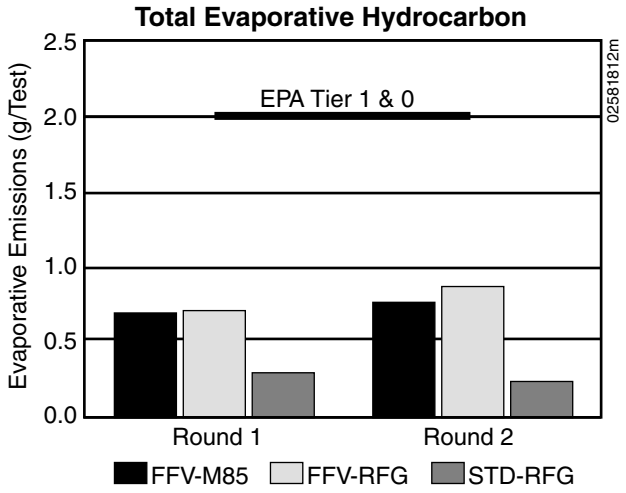


Figure 12. Evaporative emissions results from the Dodge Spirit tested at Lab 1

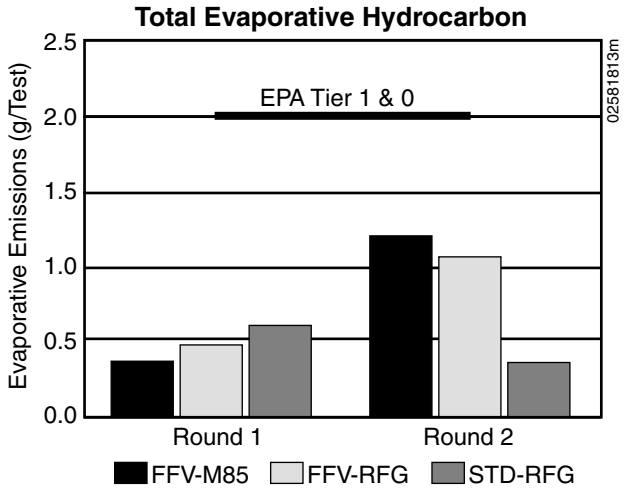


Figure 13. Evaporative emissions results From the Dodge Spirit tested at Lab 3

Because of the high variability of evaporative results, outliers were not deleted from the data sets. Round 2 evaporative results for the FFV Spirits tested at Lab 3 increased significantly over Round 1 for both fuels. This was not consistent with the results from Lab 1, and warranted a closer look. The evaporative results for the FFV Spirits tested at Lab 1 showed only 2 outliers, which had little effect on the final averages. The evaporative results from the Spirits tested at Lab 3, however, revealed several apparent outliers. Most of those data points were well above the EPA limit of 2 g per test; the highest was 6.9 g total. When those outliers were removed from the data set, the results were more consistent from lab to lab and round to round.

Greenhouse Gases

The average CO_2 emissions are shown in Figures 10d and 11d. Both labs showed the same patterns, with the FFV on M85 having the lowest CO_2 emissions and the FFV on RFG the highest. The percent difference between the FFV on M85 and on RFG was approximately 7% for both labs during both rounds. These were statistically significant differences at the 95% confidence level. Average

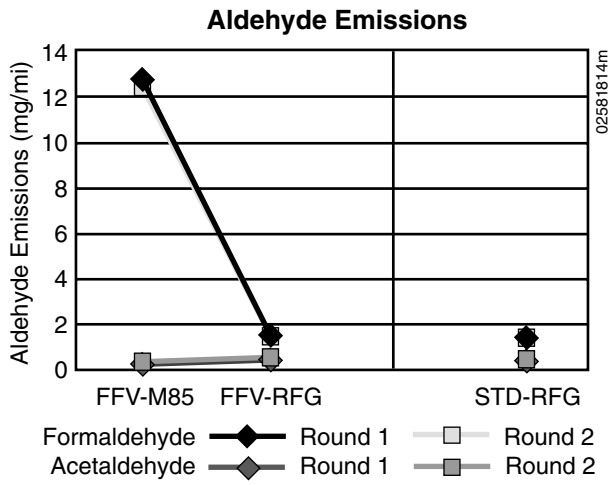


Figure 14. Aldehyde emissions from the Dodge Spirit tested at Lab 1

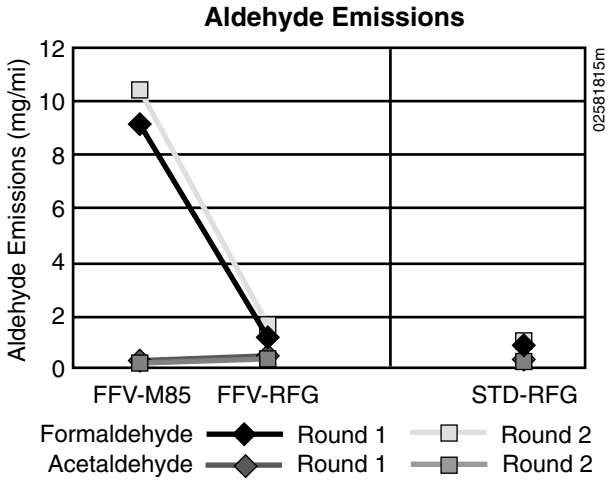


Figure 15. Aldehyde emissions from the Dodge Spirit tested at Lab 3

CO_2 emissions at Lab 1 showed a decrease between Round 1 and Round 2 that was not significant for M85, but was significant for RFG. Average CO_2 emissions at Lab 3 showed an increase from Round 1 to Round 2 for both fuels that was not statistically significant at the 95% confidence level.

Although the differences in CH_4 emissions between fuels were statistically significant for both rounds at both labs, the measured amounts were all below 0.04 g/mi. The average CH_4 values for the FFV tested on M85 were 43% to 52% less than those from the same vehicles tested on RFG. Both labs show increases in CH_4 during Round 2 for M85 and RFG. These differences between rounds were not significant for M85, but they were significant for RFG at Lab 1.

Aldehydes

The average aldehyde emissions for the Dodge Spirits are shown in Figures 14 and 15. For both labs, the formaldehyde emissions were six to eight times higher in the FFVs tested on M85. As with the Intrepid, this is expected, because formaldehyde is a primary decomposition product from methanol combustion. At Lab 1, the percent increase for the M85 tests was 764% and 772% for Rounds 1 and 2, respectively. At Lab 3, the increase was 689% and 538% for the two rounds. The average formaldehyde emissions for the FFV and the standard model (both tested on RFG) were similar.

Acetaldehyde emissions from the M85 and RFG tests were quite low (all below 0.005 g/mi). The acetaldehyde emissions were lowest on the FFV tested on M85 for both labs. At Lab 1, the FFV tested on M85 in Round 1 showed a decrease in acetaldehyde emissions of 38% and in Round 2, the decrease was 51% when compared to the FFV tested on RFG. Lab 3 showed similar decreases for M85 compared to RFG of 46% and 38% in Rounds 1 and 2, respectively. The average acetaldehyde emissions for the standard models was higher than the FFV tested on M85, but lower than those from the FFV tested on RFG for both labs.

Potency-Weighted Toxics and Ozone-Forming Potential

During this study, full speciation was performed on 10 FFV Spirits and 9 standard gasoline Spirits. Tables 18 and 19 list the average measured toxic emissions and the average PWT for the FFV Dodge Spirits tested at Labs 1 and 3. Aldehyde values are the average of the speciated vehicles only. Figures 16 and 17 illustrate the differences graphically. When comparing the FFV tested on M85 to the same vehicles tested on RFG, there was a significant increase in formaldehyde emissions, and significant decreases in acetaldehyde, 1,3-butadiene, and benzene. Total PWT for Lab 1 FFV Spirits tested on M85 was 23% lower than the total PWT for the RFG tests. At Lab 3, the difference was 46% lower for the M85 tests. All of these differences between fuels were statistically significant at the 95% confidence level. The total PWT for the gasoline control Spirits was substantially lower than the PWT for

Table 18. Toxic Emissions from the Dodge Spirit Tested at Lab 1

	FFV-M85		FFV-RFG		Percent Difference	Sig. Fuel Effect?
	Measured Value (mg/mi)	PWT	Measured Value (mg/mi)	PWT		
HCHO	14.035	0.646	1.687	0.078	731.0%	y
CH_3CHO	0.252	0.002	0.488	0.004	-50.0%	y
1,3-butadiene	0.10	0.10	0.80	0.80	-87.5%	y
Benzene	1.042	0.031	4.40	0.132	-90.2%	y
Total	15.429	0.779	7.375	1.013	-23.1%	y

Table 19. Toxic Emissions from the Dodge Spirit Tested at Lab 3

	FFV-M85		FFV-RFG		Percent Difference	Sig. Fuel Effect?
	Measured Value (mg/mi)	PWT	Measured Value (mg/mi)	PWT		
HCHO	9.725	0.447	1.538	0.071	532.3%	y
CH_3CHO	0.275	0.0022	0.475	0.0038	-42.1%	y
1,3-butadiene	0.174	0.174	0.997	0.997	-82.6%	y
Benzene	1.695	0.051	6.023	0.181	-71.9%	y
Total	11.869	0.674	9.033	1.252	-46.2%	y

Table 20. OFP for the Dodge Spirit Tested at Lab 1

	FFV-M85	FFV-RFG	Percent Difference	Sig. Fuel Effect?
NMOG (mg/mi)	191.70	151.80	26.3%	y
OFP (mg O_3/mi)	263.74	380.63	-30.7%	y
SR (mg O_3/mg NMOG)	1.385	2.908	-52.4%	y

Table 21. OFP for the Dodge Spirit Tested at Lab 3

	FFV-M85	FFV-RFG	Percent Difference	Sig. Fuel Effect?
NMOG (mg/mi)	242.56	219.18	10.7%	n
OFP (mg O_3/mi)	332.66	749.19	-55.6%	y
SR (mg O_3/mg NMOG)	1.387	3.581	-61.9%	y

the FFV Spirit tested on either fuel. This trend was consistent among labs. The decrease in PWT appears to be a direct result of the decrease in NMHCE for the gasoline Spirits compared to the FFV Spirit tested on RFG. The decrease in HC may result from the differences in calibration of the vehicle models.

Tables 20 and 21 list the NMOG, OFP, and SR for the Spirits at both labs. Figures 18 and 19 graphically illustrate these averages. The NMOG emissions from the M85 tests were higher than those from the RFG tests on this vehicle subset, but the OFP and SR were lower. As with the Intrepids, although the NMOG emissions were higher, the ozone formed from these emissions would tend to be less than that formed from the RFG emissions. The OFP and SR were significantly lower for the FFV when tested on M85. The FFV Spirits

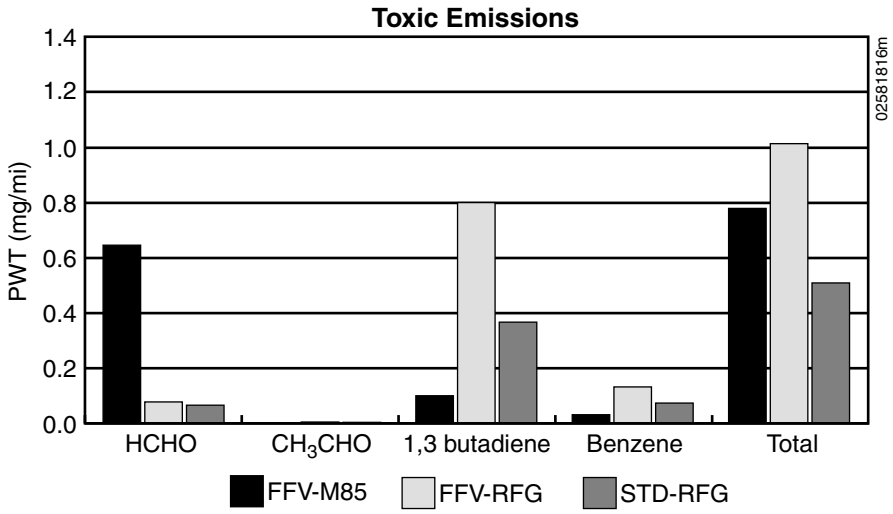


Figure 16. PWT emissions from the Dodge Spirit tested at Lab 1

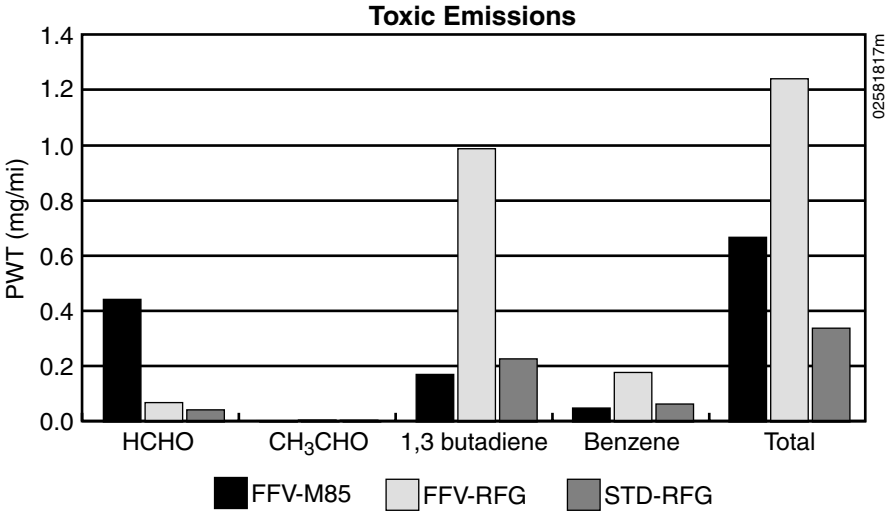


Figure 17. PWT emissions from the Dodge Spirit tested at Lab 3

tested at Lab 1 on M85 showed a 31% reduction in OFP and a 52.4% reduction in SR. Lab 3 values showed a similar finding; OFP was 55.6% lower in the M85 tests and SR was 61.8% lower.

Fuel Economy

When tested on M85, the fuel economy on the Dodge Spirits was significantly less than when the same vehicles were tested on gasoline. For Lab 1, there was a decrease of about 40% for both rounds. The Dodge Spirits tested at Lab 3 averaged 47% lower in Round 1 and 40% lower in Round 2 when tested on M85. As with the Intrepids, the energy equivalent fuel economy for the Spirits on M85 was much higher. On an energy equivalent basis, the FFV tested on M85 was 3% to 4% more energy efficient than when it was tested on RFG at Lab 1. The Spirits tested at Lab 3 during Round 1 were approximately 8% less energy efficient in Round 1, but were 4.4% more energy efficient in Round 2. Unlike the Intrepid, Dodge increased the tank size of the FFV Spirit to help offset the difference in energy content of the fuels. The tank on the gasoline control holds 16 gallons for a range of approximately 390 miles. The FFV tank holds 18 gallons for a range of approximately 245 miles on M85 and 420 miles on gasoline.

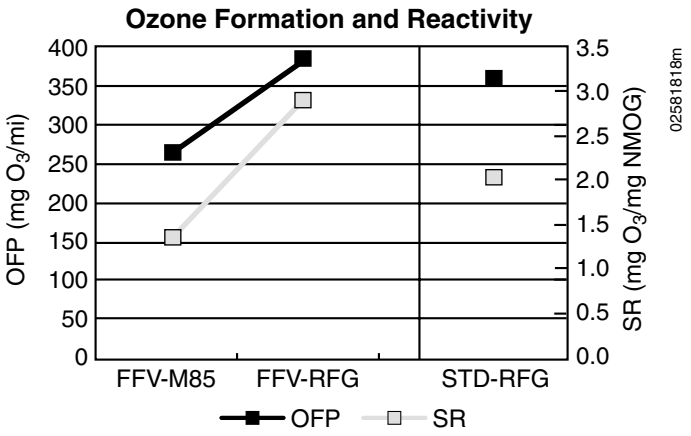


Figure 18. OFP and SP for the Dodge Spirit tested at Lab 1

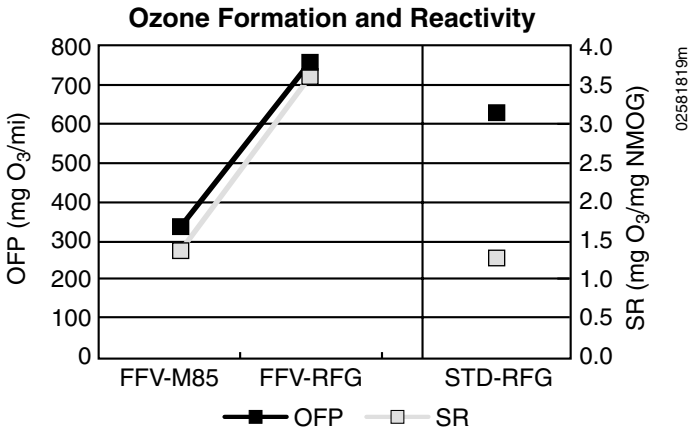


Figure 19. OFP and SR for the Dodge Spirit tested at Lab 3

ETHANOL VEHICLES

Two vehicle models were tested on ethanol during this study: the FFV Ford Taurus and the FFV Chevrolet Lumina. The Taurus was tested at Lab 1 over two rounds and the Lumina was tested at Lab 2 over three rounds. Full hydrocarbon speciation was not performed on the Lumina emissions. The following sections of this report provide a detailed discussion of the results for both vehicles. A brief overview with a more qualitative discussion of the results is presented in this section.

Table 22 and Table 23 provide a summary comparison of the average mass emissions and the hydrocarbon speciation, respectively, from E85 compared to RFG tests. As in the previous section on methanol, the shaded blocks represent a statistically significant difference (at the 95% confidence level) between average results from the two fuels. A plus sign indicates that the average E85 results were higher, and a minus sign indicates that the average E85 results were lower than the RFG results.

Table 22. Summary Comparison of Average Emission Results from E85 versus RFG

	Ford Taurus Lab 1		Chevrolet Lumina Lab 2		
	Round 1	Round 2	Round 1	Round 2	Round 3
Regulated Emissions					
NMHCE	-	+	-	-	+
THC	+	+	-	+	-
CO	+	+	+	+	+
NO_x	-	+	-	-	-
Evaporative Emissions					
THC	-	+	-	-	-
Greenhouse Gases					
CO_2	-	-	-	-	-
CH_4	+	+	+	+	+
Aldehydes					
HCHO	+	+	+	+	+
CH_3CHO	+	+	+	+	+
Fuel Economy					
mpg	-	-	-	-	-
mpeg	+	+	+	+	+

"+" Indicates results from E85 tests were higher than RFG tests
"-" Indicates results from E85 tests were lower than RFG tests
Highlighted blocks indicate a significant statistical difference.

Table 23. Summary Comparison of Average Speciated Hydrocarbon Results for E85 versus RFG

	Ford Taurus
Air Toxics	**Lab 1**
HCHO	+
CH_3CHO	+
1,3-butadiene	-
Benzene	-
Total PWT	-
Ozone Reactivity	
OFP	+
SR	-

The most obvious trend displayed in Table 22 is that the comparison of non-regulated emissions (greenhouse gases, aldehydes, and fuel economy) tended to be consistent across test rounds and vehicle types, and the differences tended to be statistically significant. Average CO_2 and mpg were consistently lower when tested on E85 compared to RFG. Average aldehydes (HCHO and CH_3CHO) and gasoline equivalent fuel economy (mpeg) were consistently higher from the E85 tests compared to the RFG tests. On the other hand, the comparison of average regulated emissions results tended to be less consistent.

Results from the FFV Taurus tended to show higher regulated emissions from E85, but the differences were not statistically significant. For the Lumina, some of the regulated emissions were significantly lower on E85 (NO_x), some tended to be significantly higher (CO), and others were mixed from round to round (THC and NMHCE).

Similar to the methanol vehicles, the ethanol vehicles are flexible-fuel designs that are not fully optimized for either gasoline or ethanol. The differences in results between vehicle models and the lack of clear regulated emissions differences may result, in part, from engine hardware choices and calibrations that must be flexible to accommodate a wide range of fuel blends.

The results from the detailed speciation of hydrocarbon emissions on the Taurus are summarized in Table 23. This table combines the results from the two rounds because the difference between the two rounds was not significant. The general trends that are evident in Table 23 include:

- Average aldehyde emissions (HCHO and CH_3CHO) tended to be higher from the E85 tests compared to the RFG tests
- Average 1,3-butadiene, benzene, and total PWT emissions tended to be significantly lower from the E85 tests compared to the RFG tests
- Average OFP tended to be higher, but SR tended to be significantly lower from the E85 tests compared to the RFG tests.

This last point was a bit surprising and deserves additional explanation. Although the OFP (expressed in milligrams of ozone per mile) was higher for the ethanol tests, the SR (expressed in terms of milligrams of ozone per milligram of non-methane organic gases) was lower. This was the case because, although the hydrocarbon emissions from the E85 tests were significantly less reactive, the total hydrocarbons from this subset of test vehicles were significantly higher when tested on E85 compared to the same vehicles tested on RFG. However, this was not the case for the larger sample of test vehicles. As was mentioned earlier, for all the Ford Taurus test vehicles, there was not a statistically significant difference between the average NMHCE emissions from E85 compared to the same vehicles tested on RFG.

Ford Taurus

The 1995 FFV Ford Taurus (Figure 20) tested in this project was actually designed to run on methanol, but GSA obtained approval to operate the vehicles on ethanol. The Taurus is a passenger car equipped with a 3.0 L V6 engine. The FFV Taurus was certified to transitional low emission vehicle (TLEV) standards and the gasoline model was certified to EPA Tier 1 levels (Table 1). Two rounds of testing were completed on the FFV Ford Taurus at Lab 1. There were 14 FFV Tauruses and 16 gasoline controls tested in both rounds. Mileage ranges and average odometer

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Figure 20. The 1995 E85 Ford Taurus

Table 24. Odometer Readings for the Ford Taurus

	FFV		Gasoline	
Round	1	2	1	2
No. vehicles tested	14	14	16	16
Odometer (miles)				
Average	5,069	16,095	4,859	14,201
Maximum	10,253	29,184	12,822	31,503
Minimum	3,067	8,158	3,027	8,055

readings for the Taurus are listed in Table 24. The complete data set for the Taurus is found in Appendix A.

Regulated Emissions

Table 25 shows the average emissions results for the FFV Ford Taurus. Figure 21 illustrates the average regulated emissions and CO_2 values. In general, when comparing the regulated emissions from the FFV Taurus tested on E85 to the same vehicles tested on RFG, there was no significant difference between fuels. In Round 1, the emissions levels from the FFV on E85 and RFG were similar to the conventional Taurus tested on RFG. In Round 2, the FFV on E85 had slightly higher values for all three regulated compounds.

When comparing the NMHCE emissions for the Taurus (Figure 21a), there was not a significant difference between the FFV on either fuel and the conventional model for Round 1. In Round 2, the NMHCE emissions for the FFV on E85 were 12.5% higher than on RFG, but this difference was not significant at the 95% confidence level. The average for the standard model in Round 2 was lower than the FFV on both fuels. All these values were below the Tier 1 limit of 0.25 g/mi. The FFV Taurus is certified to the TLEV emissions standard, which is written in terms of NMOG (see explanation on page 1). Although NMOG was not evaluated for the entire set of vehicles, it appears that the FFV in Round 2 exceeded the TLEV standard.

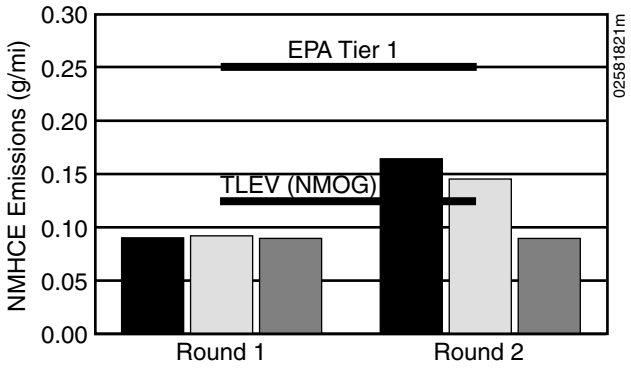
When comparing the average CO emissions for the Taurus (Figure 21b), the FFV on E85 had slightly higher values than the same vehicles tested on RFG in both rounds, but the difference was not statistically significant at the 95% confidence level. In Round 1, the increase for the FFV tested on E85 was 8% higher and in Round 2 the average was approximately 2% higher. Once again, all averages were well below the Tier 1 and TLEV limit of 3.4 g/mi.

NO_x emissions for the Taurus are shown in Figure 21c. When comparing the FFV on E85 to the same vehicles on RFG, there was a decrease in average NO_x in Round 1, but an increase in Round 2. Neither of these differences was statistically significant, and all values remained well below the Tier 1 and TLEV limit of 0.4 g/mi. The averages for all three regulated compounds showed significant increases from Round 1 to Round 2, but all were below the Tier 1 certification limit.

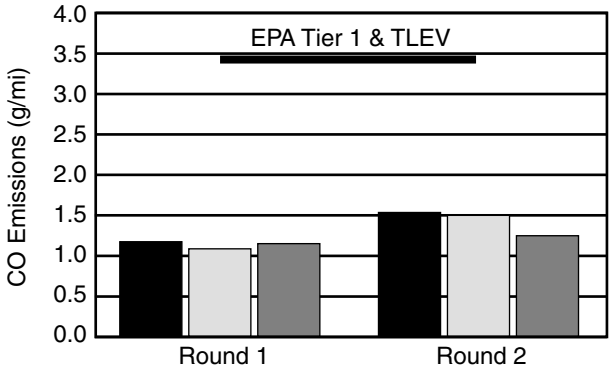
Table 25. Average Emissions Results from the Ford Taurus

	Round 1				Round 2			
	FFV-E85	FFV-RFG	Percent Difference	Sig. Fuel Effect?	FFV-E85	FFV-RFG	Percent Difference	Sig. Fuel Effect?
Regulated Emissions (g/mi)								
NMHCE	0.089	0.091	-2.2%	n	0.163	0.144	12.5%	n
THC	0.103	0.101	2.4%	n	0.184	0.156	17.9%	y
CO	1.162	1.075	8.1%	n	1.522	1.486	2.4%	n
NO_x	0.104	0.125	-16.8%	n	0.183	0.178	2.8%	n
Evaporative Emissions (g/test)								
Total Evaporative	0.328	0.332	-1.2%	n	0.362	0.319	13.5%	n
Greenhouse Gases (g/mi)								
CO_2	405.5	426.5	-4.9%	y	398.5	422.9	-5.8%	y
CH_4	0.025	0.012	107.4%	y	0.035	0.016	122.9%	y
Aldehydes (mg/mi)								
HCHO	2.03	1.29	57.4%	y	2.96	1.54	92.2%	y
CH_3CHO	9.0	0.37	2332.4%	y	13.6	0.37	3575.7%	y
Fuel Economy								
mpg	15.22	20.4	-25.4%	y	15.46	20.49	-24.6%	y
mpeg	20.82	20.4	2.1%	y	21.15	20.49	3.2%	y

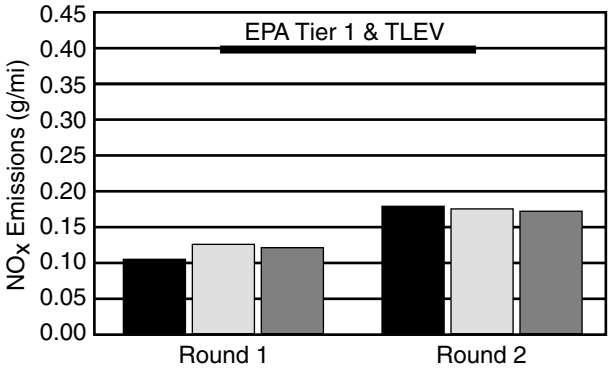
21a: Non-Methane Hydrocarbon Equivalent



21b: Carbon Monoxide



21c: Oxides of Nitrogen



21d: Carbon Dioxide

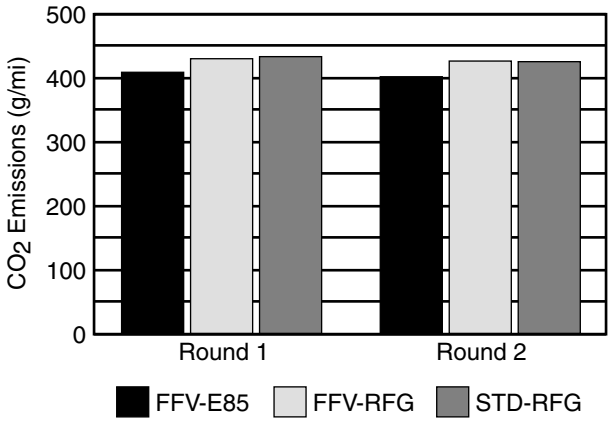


Figure 21. Emissions results from the Ford Taurus

Evaporative Emissions

Figure 22 shows the comparison of the average evaporative emissions for the Taurus. Evaporative emissions for the FFV on both fuels and the conventional Tauruses were well below the EPA limit of 2 g of hydrocarbon per test. When comparing the evaporative emissions for the FFV Taurus, there was not a significant difference in the FFV tested on E85 and the same vehicles tested on RFG. The conventional Taurus had lower average evaporative emissions than the FFV on either fuel. The round-to-round comparison for the FFV showed a small increase for the E85 tests, and a small decrease for the RFG tests. Neither of these differences was statistically significant at the 95% confidence level.

Greenhouse Gases

Carbon dioxide emissions for the Taurus are shown in Figure 21d. When comparing the FFV on E85 to the same vehicles tested on RFG, the E85 CO_2 emissions were approximately 5% lower in both rounds. This difference was statistically significant at the 95% confidence level. The conventional Taurus tested on RFG showed very similar values to the FFV tested on RFG. There was a small decrease in CO_2 emissions for Round 2 that was statistically significant for both fuels.

Methane emissions for the FFV tested on E85 were significantly higher than when the same vehicles were tested on RFG. The average CH_4 emissions were 107% higher in Round 1 and 123% higher in Round 2. It is important to note, however, that the values for both fuels are very small (0.012 to 0.035 g/mi). There was a small increase in CH_4 emissions from Round 1 to Round 2 that was significant for both fuels.

Total Evaporative Hydrocarbon

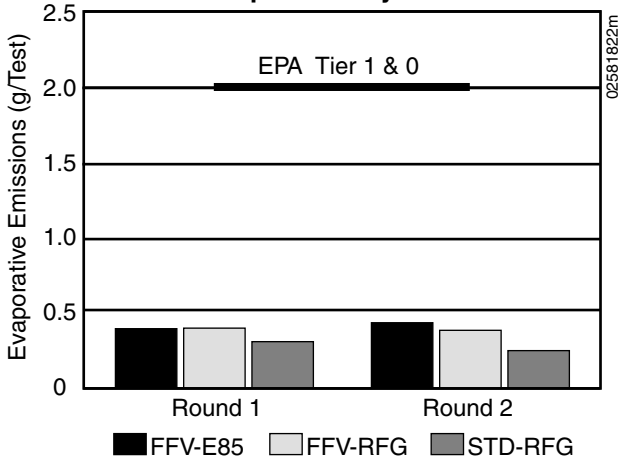


Figure 22. Evaporative emissions results from the Ford Taurus

Aldehydes

Aldehyde emissions for the Ford Taurus are shown in Figure 23. Formaldehyde emissions were higher for the FFV tested on E85 in both rounds. The percent difference between the FFV tested on E85 and the same vehicles tested on RFG was 57% for Round 1 and 92.2% for Round 2. Acetaldehyde is a primary decomposition product from ethanol combustion; therefore, the much higher values were expected when the vehicle was operating on E85. The percent increase in the FFV acetaldehyde emissions when tested on E85 was 2,332% for Round 1 and 3,575% for Round 2. The acetaldehyde levels for RFG were very low—less than 0.5 mg/mi. Although both fuels show increases in aldehyde emissions from Round 1 to Round 2, only the increases for the E85 tests were statistically significant.

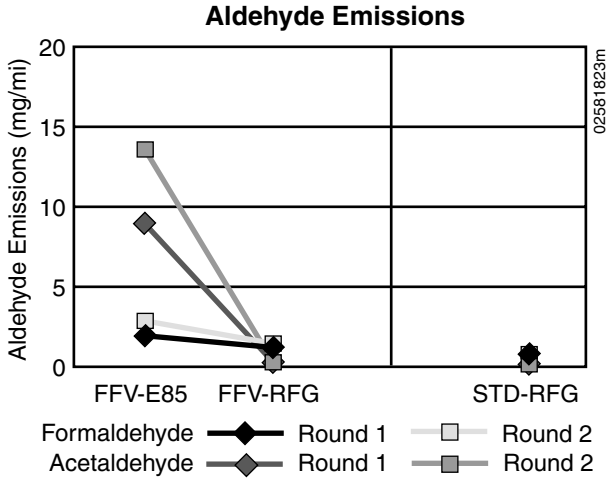


Figure 23. Aldehyde emissions from the Ford Taurus

Potency-Weighted Toxics and Ozone-Forming Potential

During this project, full hydrocarbon speciation was performed on six of the FFVs and five of the standard Tauruses. Table 26 summarizes the average measured toxic emissions and the PWT results for the Taurus. When comparing the FFV tested on E85 to the same vehicles tested on RFG, there were significant increases in aldehyde emissions and significant decreases in 1,3-butadiene and benzene. Figure 24 shows this difference graphically. Although the total measured toxics were higher, the potency weighted values were significantly lower for the E85 tests. Total PWT for the FFV tested on E85 were 44% lower than the same vehicles tested on RFG. Although acetaldehyde is the highest measured value for E85 tests, it is the least toxic of the four. The conventional model tested on RFG showed results similar to the FFV tested on RFG.

Table 27 and Figure 25 show the NMOG, OFP, and SR results for the Taurus. The OFP for the FFV tested on E85 was significantly higher (19%) than the same vehicles tested on RFG, but the SR was significantly lower (approximately 38%) for the E85 tests. The OFP for the FFV tested on E85 was higher than the same vehicles tested on RFG because the total HC from this subset of vehicles were substantially higher. The lower SR indicates that the FFV tested on E85 was less reactive per unit mass.

Fuel Economy

Table 25 gives the actual and equivalent fuel economy for the FFV Ford Taurus. Average fuel economy for the FFV Taurus on E85 was approximately 15 mpg. The average when tested on RFG was approximately 25% higher, at 20 mpg. As with methanol, E85 has a lower volumetric energy content than RFG. The volumetric energy content for E85 (81,825 Btu/gal) is approximately 73% of RFG (111,960 Btu/gal). This

Table 26. Toxic Emissions from the Ford Taurus

	FFV-E85		FFV-RFG		Percent Difference	Sig. Fuel Effect?
	Measured Value (mg/mi)	PWT	Measured Value (mg/mi)	PWT		
HCHO	2.223	0.102	1.30	0.06	70.9%	y
CH_3CHO	9.854	0.079	0.275	0.002	3,490.9%	y
1,3-butadiene	0.175	0.175	0.544	0.544	-67.8%	y
Benzene	1.013	0.03	2.863	0.086	-65.1%	y
Total	13.265	0.386	4.982	0.692	-44.2%	y

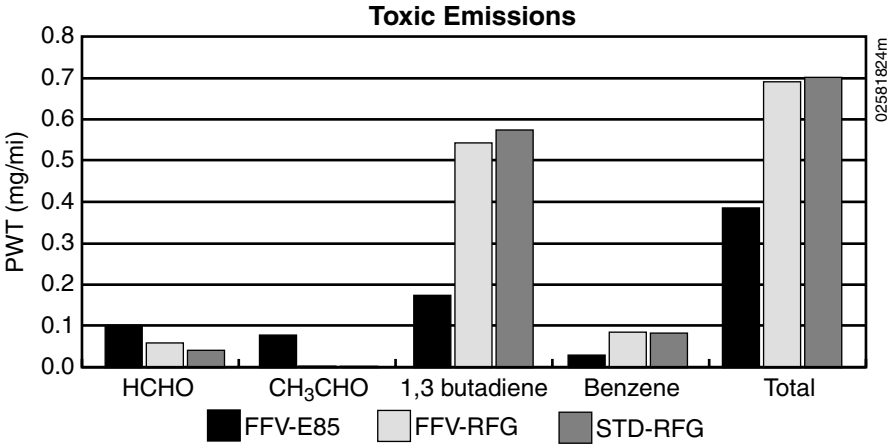


Figure 24. PWT emissions from the Ford Taurus

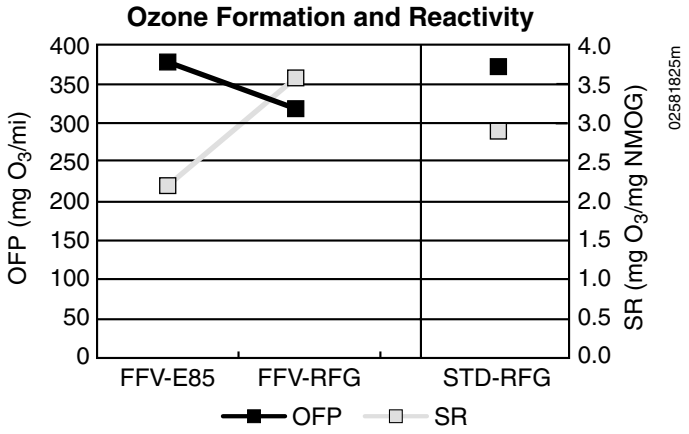


Figure 25. OFP and SR for the Ford Taurus

Table 27. OFP for the Ford Taurus

	FFV-E85	FFV-RFG	Percent Difference	Sig. Fuel Effect?
NMOG (mg/mi)	171.97	92.30	86.3%	y
OFP (mg O_3/mi)	377.58	318.06	18.7%	y
SR (mg O_3/mg NMOG)	2.215	3.57	-38.0%	y

means that it takes 1.3 gallons of E85 to travel the same distance as 1 gallon of gasoline. On an energy equivalent basis, the FFV Taurus was 2% to 3% more energy efficient when tested on E85. Like the Spirit, the fuel tank of the FFV Taurus was increased to account for the differing energy content of the fuel. The gasoline Taurus has a 16-gallon tank for a range of approximately 326 miles. The FFV has a tank that holds 20.4 gallons for a range of 313 miles on E85 and 417 miles on gasoline.

Chevrolet Lumina

The 1993 FFV Chevrolet Lumina (shown in Figure 26) is a passenger car equipped with a 3.1 L V6 engine with multi-point fuel injection. The Lumina was certified to EPA federal Tier 0 emissions levels. This report covers the three rounds of testing completed on the Chevrolet Lumina at Lab 2. Ten FFV Luminas and 11 gasoline controls were tested in all 3 rounds. Mileage ranges and average odometer readings for the Luminas are listed in Table 28. Lab 1 tested a limited number of FFV Luminas during Round 1 only. The results for those tests were reported in another publication and are not included in this paper.[9] Hydrocarbon speciation was not performed on the vehicles included in this analysis. The entire data set is located in Appendix A.

Regulated Emissions

The average emissions results for the Lumina are listed in Table 29. The regulated and CO_2 emissions for the FFV Lumina are shown in Figure 27. In general, when comparing the FFV tested on E85 to the same vehicles tested on RFG, there tended to be a slight decrease in NMHCE, a larger decrease in NO_x, and an increase in CO emissions. The average regulated emissions for the FFV Lumina were all well below the Tier 0 standard, as well as the more stringent Tier 1 standard, shown here for reference. The regulated emissions for the gasoline model did not follow the same trend. NMHCE and NO_x emissions for the gasoline Lumina were below the Tier 0 levels, but CO emissions were over the limit for all 3 rounds.

Although NMHCE values for the FFV tested on E85 were lower than the RFG tests in Rounds 1 and 2 (see Figure 27a), the difference was not significant in Round 2. There was no significant difference in NMHCE emissions between the two fuels for Round 3. All the values for the FFV Lumina were below the EPA Tier 1 limit of 0.25 g/mi. Round-to-round comparison for the E85 tests showed an increase in NMHCE over time that was statistically significant. The smaller increase in NMHCE for the RFG tests on the FFV was not statistically significant at the 95% confidence level. The standard gasoline

model showed a small but significant increase in each round.

CO emissions follow a different trend than NMHCE (Figure 27b). In all three rounds, the FFV tested on E85 showed higher CO emissions than when the same vehicles were tested on RFG. The percent increases were 7.5% for Round 1, 33% for Round 2, and 22% for Round 3. This increase was statistically significant for Rounds 2 and 3, but not for Round 1. The standard gasoline model tested significantly higher than the FFV on either fuel. The average CO for the FFV tested on E85 and RFG were below the Tier 0 emissions standard, but the gasoline Lumina exceeded the limit for all three rounds. The Round 3 average for the gasoline Luminas was approximately 50% higher than the 3.4 g/mi standard.

NO_x emissions for the FFV tested on E85 were significantly lower than those from the same vehicles tested on RFG for all 3 rounds. There was a decrease of 40%, 37%, and 34% for Rounds 1, 2, and 3, respectively. As with the CO emissions, NO_x averages for the standard model were much higher than the averages for the FFV. Both the FFV tested on E85 and RFG and the standard model tested on RFG had NO_x levels below the Tier 0 standard of 1 g/mi. The FFV on each fuel was also below the more stringent Tier 1 level.

Evaporative Emissions

Evaporative emissions for the FFV Lumina are listed in Table 29 and graphically illustrated in Figure 28. When comparing the average evaporative emissions for the FFV tested on E85 to the averages for the same vehicles tested on RFG, there was a small reduction in evaporative emissions for all three rounds. However, only the reduction for Round 2 was statistically significant. The conventional Lumina tested higher than

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Figure 26. The 1993 E85 Chevrolet Lumina

Table 28. Odometer Readings for the Chevrolet Lumina

	FFV			Gasoline		
Round	1	2	3	1	2	3
No. vehicles tested	10	10	10	11	11	11
Odometer (miles)						
Average	10,111	22,568	30,883	6,344	12,434	19,403
Maximum	12,409	35,842	42,538	10,713	18,970	37,902
Minimum	8,218	12,991	19,700	2,903	6,826	11,365

the FFV on both fuels. All averages were well below the 2 g per test standard. Round-to-round differences show small increases over time for the FFV on both fuels. These differences tended not to be significant at the 95% confidence level.

Greenhouse Gases

Figure 27d shows the average CO_2 emissions levels for the Lumina. The CO_2 average for the FFV tested on E85 was approximately 6% lower than when tested on RFG in all three rounds. These differences were all statistically significant at the 95% confidence level. CO_2 emissions for the standard Lumina tested on RFG were lower than the FFV on RFG. Round-to-round comparisons for the FFV tested on E85 and RFG showed significant decreases in CO_2 during Round 2 and significant increases in Round 3. This held true for both the E85 and RFG tests on the FFV Lumina.

Although emissions of CH_4 for the FFV are small (less than 0.08 g/mi), the results for the tests on E85 are significantly higher than those from the RFG tests. Round-to-round comparisons of CH_4 emissions for the E85 tests show a small but significant increase in Round 2 and a small but significant decrease in Round 3. The FFV tests with RFG show no

Table 29. Average Emissions Results from the Chevrolet Lumina

	Round 1				Round 2				Round 3			
	FFV E85	FFV RFG	Percent Difference	Sig. Fuel Effect?	FFV E85	FFV RFG	Percent Difference	Sig. Fuel Effect?	FFV E85	FFV RFG	Percent Difference	Sig. Fuel Effect?
Regulated Emissions (g/mi)												
NMHCE	0.087	0.102	-14.7%	y	0.105	0.109	-3.7%	n	0.118	0.117	0.8%	n
THC	0.106	0.125	-14.5%	y	0.140	0.134	4.5%	n	0.141	0.1414	-0.3%	n
CO	2.22	2.07	7.5%	n	3.08	2.32	32.9%	y	2.84	2.33	21.3%	y
NO_x	0.156	0.261	-40.4%	y	0.206	0.329	-37.4%	y	0.233	0.352	-34.1%	y
Evaporative Emissions (g/test)												
Total Evaporative	0.153	0.162	-5.6%	n	0.159	0.242	-34.3%	y	0.163	0.207	-21.3%	n
Greenhouse Gases (g/mi)												
CO_2	454.2	485.9	-6.5%	y	435.9	462.5	-5.7%	y	443.9	468.9	-5.3%	y
CH_4	0.056	0.028	100%	y	0.074	0.031	141.6%	y	0.066	0.031	110.6%	y
Aldehydes (mg/mi)												
HCHO	6.98	4.66	49.8%	y	5.56	3.92	41.8%	y	5.38	3.36	60.1%	y
CH_3CHO	18.08	0.73	2482.9%	y	17.04	0.78	2030%	y	17.98	0.70	2468.6%	y
Fuel Economy												
mpg	13.57	18.09	-25.0%	y	14.1	18.99	-25.8%	y	13.86	18.72	-26%	y
mpeg	18.57	18.09	2.6%	y	19.29	18.99	1.6%	y	18.96	18.72	1.3%	y

significant difference between rounds. Average CH_4 values for the gasoline Lumina also show no significant difference between rounds.

Aldehydes

Aldehyde emissions for the Lumina are shown in Figure 29. Formaldehyde emissions from the FFV tested on E85 were significantly higher than those from the same vehicles tested on RFG. In Round 1, formaldehyde emissions from the FFV on E85 were 50% higher than those from RFG, Round 2 results were 42% higher, and Round 3 results were 60% higher. Formaldehyde emissions for the standard Lumina were higher than those from the FFV on RFG, but lower than those from the FFV on E85. The average acetaldehyde (a primary decomposition product of ethanol combustion) emissions for the FFV tested on E85 were 2,483%, 2,030%, and 2,469% higher than those from the same vehicles tested on RFG, respectively. The differences between rounds were not statistically significant.

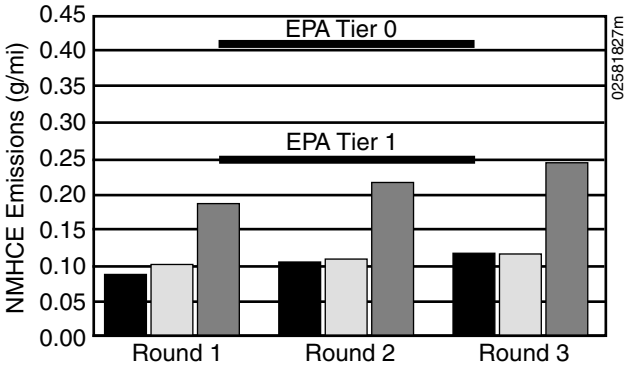
Potency-Weighted Toxics and Ozone -Forming Potential

Because full hydrocarbon speciation was not performed on the Luminas during this project, PWT and OFP were not evaluated.

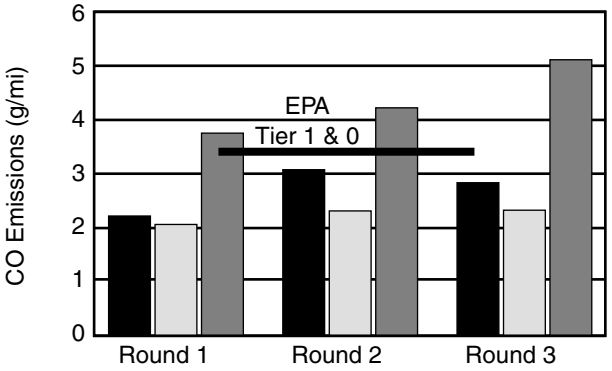
Fuel Economy

Table 29 gives actual and equivalent fuel economy for the FFV Lumina. Actual fuel economy for the Lumina tested on E85 over the 3 rounds ranged from 13.5 to 14 mpg. This was 25% to 26% lower than the same vehicles when tested on RFG. The standard models tested slightly higher than the FFV on RFG. Because of the difference in energy content between E85 and RFG, gasoline energy equivalent fuel economy was calculated for the E85 tests. The energy equivalent fuel economy for the E85 tests ranged from 18.6 mpeg to 19.3 mpeg. Taking this into account, the fuel economy for the FFV tested on E85 was 1.3% to 2.6% higher than when tested on RFG. The fuel tanks for the gasoline and FFV Lumina are similar in size. The gasoline Lumina has a tank that holds 17.1 gallons for a range of approximately 330 miles. The FFV Lumina has a 16.5-gallon fuel tank for a range of 228 miles on E85 and 306 miles on gasoline.

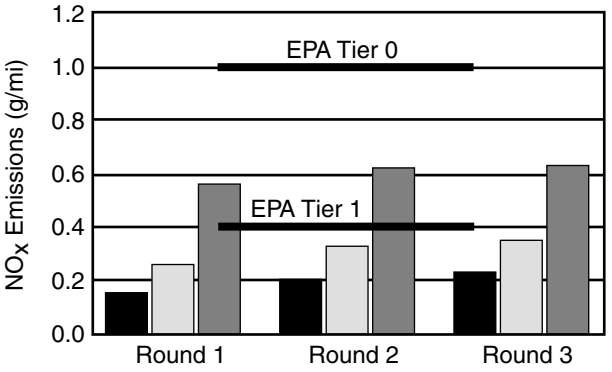
27a: Non-Methane Hydrocarbon Equivalent



27b: Carbon Monoxide



27c: Oxides of Nitrogen



27d: Carbon Dioxide

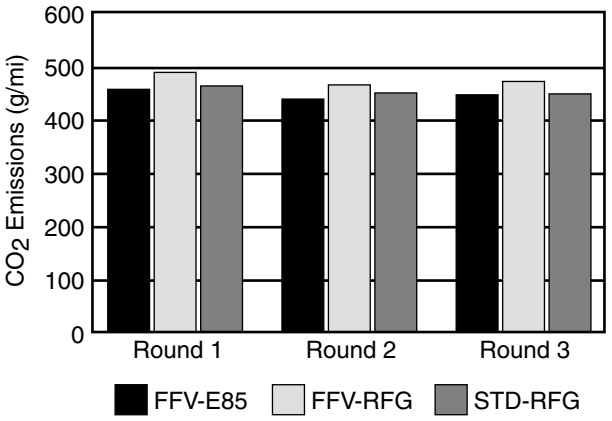


Figure 27. Emissions results from the Chevrolet Lumina

Total Evaporative Hydrocarbon

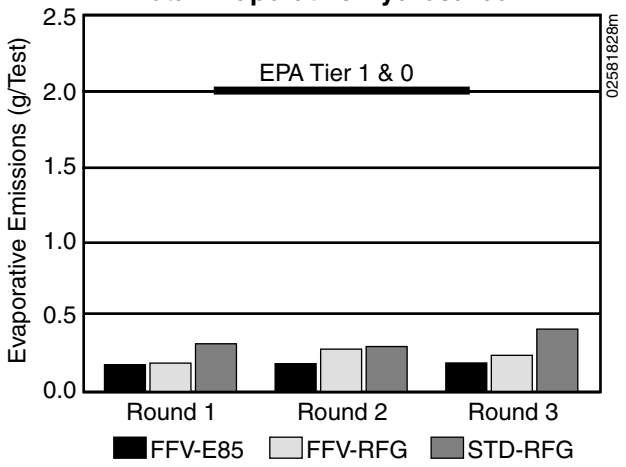


Figure 28. Evaporative emissions results from the Chevrolet Lumina

Aldehyde Emissions

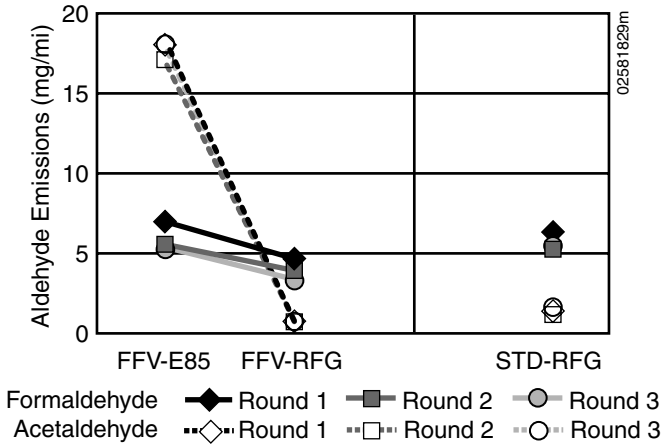


Figure 29. Aldehyde emissions from the Chevrolet Lumina

COMPRESSED NATURAL GAS VEHICLES

Two different CNG vehicle models were tested during this study. These models include the Dodge B250 van and the Dodge Caravan minivan. Both vans are dedicated natural gas vehicles, which means they are designed to operate on CNG only. To make fuel-to-fuel emissions comparisons, it was necessary to test closely matched gasoline vehicles. The AFV and the gasoline models are both classified by the EPA as "heavy light-duty vehicles." See Table 2 on page 2 for the EPA intermediate useful life standards for the vans.

As with the other fuels, an overview of the general trends is presented first and then the detailed results for each of the test vehicles are presented in subsequent sections. Table 30 and Table 31 show summary comparisons of the average CNG emissions compared to the average RFG emissions. As in the sections on methanol and ethanol, the shaded blocks indicate differences between the averages that were statistically significant (at the 95% confidence level). Plus signs indicate that the average CNG emissions were higher than the average RFG emissions, and the minus signs indicate that the

Table 30. Summary Comparison of Average Emissions Results from CNG versus RFG

	Dodge B250								Dodge Caravan
	Lab 1		Lab 2			Lab 3			Lab 1
	Round 1	Round 2	Round 1	Round 2	Round 3	Round 1	Round 2	Round 3	Round 1
Regulated Emissions									
NMHC	-	-	-	-	-	-	-	-	-
THC	-	-	+	+	+	+	+	+	-
CO	-	-	-	-	-	-	-	-	-
NO_x	-	-	-	-	+	-	-	-	-
Evaporative Emissions									
THC	-	-	-	-	-	-	-	-	-
Greenhouse Gases									
CO_2	-	-	-	-	-	-	-	-	-
CH_4	+	+	+	+	+	+	+	+	+
Aldehydes									
HCHO	-	-	+	-	+	-	-	-	+
CH_3CHO	-	-	-	-	-	-	-	-	-
Fuel Economy									
mpg	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
mpeg	-	-	-	-	-	-	-	-	-

"+" Indicates results from CNG tests were higher than RFG tests
"-" Indicates results from CNG tests were lower than RFG tests
Highlighted blocks indicate a significant statistical difference.

Table 31. Summary Comparison of Average Speciated Hydrocarbon Results from CNG versus RFG

	Dodge B250 Van	
Air Toxics	**Lab 1**	**Lab 3**
HCHO	-	-
CH_3CHO	-	-
1,3-butadiene	-	-
Benzene	-	-
Total PWT	-	-
Ozone Reactivity		
OFP	-	-
SR	-	-

average CNG emissions were lower than the average RFG emissions. Table 30 includes mass emissions results from the B250s that were tested over multiple rounds at all 3 labs, and more limited results from the Caravans that were only tested during a single round at Lab 1. Table 31 includes results from detailed hydrocarbon speciations of emissions from the B250 tests performed at Labs 1 and 3.

Table 30 shows that there tend to be statistically significant differences between the average emissions from the CNG and RFG B250 vans, and that these results tend to be fairly consistent from lab to lab and from round to round. The average NMHC, CO, CO_2, CH_3CHO, and fuel economy results were significantly lower from the CNG tests than the RFG tests for all three labs and in all three test rounds. Average CH_4 emissions were consistently higher from CNG than from RFG. NO_x and "evaporative" hydrocarbons tended to be lower from the CNG tests, but in some cases the differences were not significant, and in one case (Lab 2, Round 3) the average NO_x emissions were higher from CNG. The evaporative emissions test is a measure of the hydrocarbons emanating from two, 1-hour soaks in a sealed room with the engine off. Dedicated gaseous fuel vehicles typically do not have evaporative control systems because the fuel system is said to be sealed under pressure. Nevertheless, hydrocarbons (mostly methane) may still be found emanating from gaseous fuel vehicles. In all cases, the average THC measured during the evaporative tests were lower than from the RFG tests, but in a few cases the difference was not statistically significant.

Results from a subset of the vehicles (on which detailed speciation of the hydrocarbon emissions was performed) are summarized in Table 31. The general trend of these results was very consistent for the 2 labs where this analysis was performed. At both labs, the CNG emissions had lower average values of the four toxic emissions that were quantified, had lower PWT, lower average OFP, and lower average SR. These differences were all deemed statistically significant at the 95% confidence level.

Dodge B250 Van

The CNG and the gasoline Dodge B250 vans are full-size passenger vans equipped with a 5.2 L V8 engine. Both models have multi-point fuel injection and 4 speed automatic transmissions. The gasoline model was certified to EPA Tier 0 standards. The CNG model had received a waiver on emissions certification. The vehicles tested in this project were a mixture of 1992 and 1994 model year vans. Figure 30 shows the 1992 model year CNG Dodge van.

The gasoline model has a 35-gallon fuel tank, and the CNG model was equipped with 3 or 4 fuel cylinders mounted under the vehicle. The 3-cylinder configuration gives a capacity of 11.1 equivalent gallons and the 4-cylinder configuration gives a capacity of 15.7 equivalent gallons.

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Figure 30. The 1992 CNG Dodge B250 van

Two rounds of testing were completed on the Dodge B250 vans at Lab 1, and three rounds were completed at Labs 2 and 3. At Lab 1, 10 CNG vans and 8 gasoline controls were tested in both rounds. The vans tested at Lab 2 in all 3 rounds totaled 12 CNG vehicles and 13 gasoline vehicles. At Lab 3, 15 CNG vehicles and 14 gasoline models were tested in all 3 rounds. Mileage ranges and average odometer readings for the B250 vans tested at the three labs are listed in Tables 32, 33, and 34. All data for the Dodge B250 vans can be found in Appendix A.

Regulated Emissions

Table 35 lists the average emissions values for the B250 vans tested at Lab 1 along with the percent difference and an indication of whether the differences are statistically significant at the 95% confidence level. Table 36 lists the values for the vans tested at Lab 2 and Table 37 for those tested at Lab 3. Figures 31–33 show the graphical representation of the average regulated and CO_2 exhaust emissions for the Dodge B250 vans tested at Labs 1, 2, and 3, respectively. Regulated emissions results for both the CNG and gasoline vans were well below the Tier 0 standard. The CNG vans, although not certified, tended to be below the more stringent Tier 1 standard.

Average NMHC emissions are shown in Figures 31a, 32a, and 33a for Labs 1, 2, and 3, respectively. All NMHC values were not only below the Tier 0 full useful life standard of 0.67 g/mi, but were also below the more stringent Tier 1 full useful life standard of 0.4 g/mi. NMHC emissions for the B250 vans were significantly lower in the CNG model for all 3 labs. Lab 1 showed the largest percent difference at approximately 94% lower for the CNG model during both rounds. Lab 2 showed a 76% to 85% decrease in NMHC for the CNG model. Lab 3 showed a decrease in NMHC of 81% in Round 1, 41% in Round 2, and 45% in Round 3. The higher percentage for Lab 1 could be due partially to the discrepancy in odometer reading between the CNG and gasoline models. The average odometer for the CNG vans was 5,412 miles in Round 1 and 12,154 miles in Round 2. In contrast, the average odometer for the gasoline model was 39,749 miles and 45,755 miles for Rounds 1 and 2, respectively. All of the vans tested at Lab 1 were from the 1994 model year. Round-to-round comparisons at Lab 1 showed a significant increase in NMHC for the RFG tests in Round 2, but no significant difference between rounds for the CNG tests at Lab 1. At Lab 2, the CNG tests showed a significant increase from Round 1 to Round 2, and the RFG tests increased significantly from Round 2 to Round 3. Lab 3 CNG tests increased significantly

Table 32. Odometer Readings for the Dodge B250 Van Tested at Lab 1

	CNG		Gasoline	
Round	1	2	1	2
No. vehicles tested	10	10	10	8
Odometer (miles)				
Average	5,412	12,154	39,749	45,755
Maximum	6,611	15,527	107,350	60,261
Minimum	3,455	8,047	23,991	33,050

Table 33. Odometer Readings for the Dodge B250 Van Tested at Lab 2

	CNG			Gasoline		
Round	1	2	3	1	2	3
No. vehicles tested	12	12	12	13	13	13
Odometer (miles)						
Average	7,246	11,778	15,633	11,429	18,327	27,037
Maximum	15,026	24,824	30,050	22,195	32,165	57,099
Minimum	3,951	5,377	6,243	3,527	3834	9,363

Table 34. Odometer Readings for the Dodge B250 Van Tested at Lab 3

	CNG			Gasoline		
Round	1	2	3	1	2	3
No. vehicles tested	15	15	15	14	14	14
Odometer (miles)						
Average	6,978	12,051	18,515	13,321	17,338	19,670
Maximum	22,245	29,585	45,147	30,493	36,629	38,485
Minimum	2,121	3,455	6,782	3,875	5,210	6,720

Table 35. Average Emissions Results from the Dodge B250 Van Tested at Lab 1

	Round 1				Round 2			
	CNG	STD-RFG	Percent Difference	Sig. Fuel Effect?	CNG	STD-RFG	Percent Difference	Sig. Fuel Effect?
NMHC	0.018	0.323	-94.3%	y	0.022	0.362	-93.8%	y
THC	0.288	0.387	-25.7%	y	0.383	0.431	-11.1%	y
CO	0.651	5.615	-88.4%	y	0.734	6.846	-89.3%	y
NO_x	0.287	0.858	-66.6%	y	0.521	0.888	-41.3%	y
Evaporative Emissions (g/test)								
Total Evaporative	0.0684	0.6999	-90.2%	y	0.4501	0.8749	-48.5%	y
Greenhouse Gases (g/mi)								
CO_2	539.16	637.87	-15.5%	y	526.54	617.84	-14.8%	y
CH_4	0.27	0.078	244.8%	y	0.362	0.085	325.2%	y
Aldehydes (mg/mi)								
HCHO	2.08	6.45	-67.7%	y	2.31	6.13	-62.3%	y
CH_3CHO	0.17	1.25	-86.7%	y	0.26	1.38	-80.9%	y
Fuel Economy	12.97	13.49	-3.9%	y	12.5	13.73	-9.0%	y

Table 36. Average Emissions Results from the Dodge B250 Van Tested at Lab 2

	Round 1				Round 2				Round 3			
	CNG	STD RFG	Percent Difference	Sig. Fuel Effect?	CNG	STD RFG	Percent Difference	Sig. Fuel Effect?	CNG	STD RFG	Percent Difference	Sig. Fuel Effect?
Regulated Emissions (g/mi)												
NMHC	0.045	0.306	-85.4%	y	0.071	0.325	-78.1%	y	0.083	0.352	-76.3%	y
THC	0.759	0.367	106.6%	y	1.017	0.387	163.2%	y	1.273	0.416	205.7%	y
CO	1.747	5.994	-70.9%	y	1.604	5.954	-73.1%	y	1.393	7.079	-80.3%	y
NO_x	0.547	0.762	-28.3%	n	0.757	0.810	-6.5%	n	1.290	0.853	51.2%	y
Evaporative Emissions (g/test)												
Total Evaporative	0.406	0.621	-34.7%	y	0.317	0.803	-60.5%	y	0.267	1.060	-74.9%	y
Greenhouse Gases (g/mi)												
CO_2	559.5	667.9	-16.2%	y	547.2	644.5	-15.1%	y	548.1	644.4	-14.9%	y
CH_4	0.716	0.075	853.7%	y	0.94	0.077	1,127.7%	y	1.192	0.080	1,386.7%	y
Aldehydes (mg/mi)												
HCHO	8.14	7.41	9.9%	n	6.09	6.43	-5.4%	n	8.79	5.79	51.9%	y
CH_3CHO	0.37	1.71	-78.3%	y	0.37	1.56	-76.3%	y	0.50	1.96	-74.6%	y
Fuel Economy	11.64	13.08	-11.0%	y	11.89	13.45	-11.6%	y	11.86	13.51	-12.2%	y

from Round 1 to 2, but the RFG tests did not show a significant difference between the rounds.

The average CO emissions for the B250 vans tested at the 3 labs are shown in Figures 31b, 32b, and 33b. Average results were below the Tier 0 full useful life standard for CO. Although the CNG vans were not certified, the average CO emissions for these vehicles were below the more stringent Tier 1 levels at all 3 labs. The average CO emissions from the CNG vehicles at Lab 1 were 88% and 89% lower than the RFG emissions for Rounds 1 and 2, respectively. Lab 2 showed a decrease in CO for the CNG vans of 71% in Round 1, 73% in Round 2, and 80% in Round 3. Lab 3 showed a decrease of 35.5% in Round 1, 48% in Round 2, and 53% in Round 3. Round-to-round comparisons of CO emissions at Lab 1 show a significant increase in Round 2 for the RFG tests, but no significant difference between rounds for the CNG tests. The only significant increase in CO emissions at Lab 2 was for the RFG tests from Rounds 2 to 3. The CO emissions for the CNG vans at Lab 2 showed a slight downward trend that was not significant at the 95% confidence level. This same trend was seen with the CNG vans tested at Lab 3. The RFG vans at Lab 3 showed a significant CO increase in Round 2 and a significant decrease in Round 3.

Average NO_x emissions for the B250s tested at the 3 labs are shown in Figures 31c, 32c, and 33c. The average NO_x emissions for the B250 vans were below the federal Tier 0 standard of 1.7 g/mi. The average NO_x emissions for the CNG vans were lower than that of the gasoline models except for the third round at Lab 2. At Lab 1, the CNG emissions were 66.5% lower in Round 1 and 41% lower in Round 2. Lab 3 also followed this trend; Round 1 CNG emissions were 45.5% lower, Round 2 were 31% lower, and Round 3 were 10.7% lower. The average NO_x emissions for both van models were below the Tier 0 as well as the more stringent Tier 1 limits. The exception to this trend was seen at Lab 2. Rounds 1 and 2 showed a decrease in NO_x emissions for the CNG model, but this difference was not significant. In Round 3, the CNG average for NO_x was 51% higher than the average for the gasoline model. This was mainly caused by one high-emitting van, which was not tagged as an outlier. During Bag 3 of the FTP on this van, the check engine light came on, indicating a possible problem. If this value is removed, the CNG average is lowered to 0.997 g/mi, but this is still higher than the gasoline average by 16.9%. Round-to-round comparisons of NO_x emissions at all 3 labs showed an increasing trend for the CNG vans

Table 37. Average Emissions Results from the Dodge B250 Van Tested at Lab 3

	Round 1				Round 2				Round 3			
	CNG	STD RFG	Percent Difference	Sig. Fuel Effect?	CNG	STD RFG	Percent Difference	Sig. Fuel Effect?	CNG	STD RFG	Percent Difference	Sig. Fuel Effect?
Regulated Emissions (g/mi)												
NMHC	0.049	0.257	-80.9%	y	0.179	0.304	-41.1%	y	0.170	0.310	-45.2%	y
THC	0.710	0.311	128.1%	y	0.741	0.353	109.9%	y	0.797	0.365	118.4%	y
CO	2.563	3.974	-35.5%	y	2.458	4.713	-47.9%	y	1.828	3.877	-52.9%	y
NO_x	0.379	0.695	-45.5%	y	0.506	0.738	-31.4%	y	0.709	0.794	-10.7%	n
Evaporative Emissions (g/test)												
Total Evaporative	0.571	1.041	-45.2%	n	0.524	1.39	-62.3%	y	0.764	1.35	-43.4%	y
Greenhouse Gases (g/mi)												
CO_2	502.3	616.0	-18.5%	y	494.1	604.8	-18.3%	y	488.1	606.25	-19.5%	y
CH_4	0.66	0.054	1,134.5%	y	0.557	0.049	1,030.6%	y	0.617	0.055	1,026.3%	y
Aldehydes (mg/mi)												
HCHO	1.68	3.62	-53.6%	y	1.82	3.85	-52.7%	y	1.86	3.87	-51.9%	y
CH_3CHO	0.089	1.03	-91.3%	y	0.196	1.06	-81.4%	y	0.2	1.08	-81.4%	y
Fuel Economy	13.32	13.93	-4.4%	y	13.66	14.16	-3.5%	y	13.86	14.15	-2.0%	y

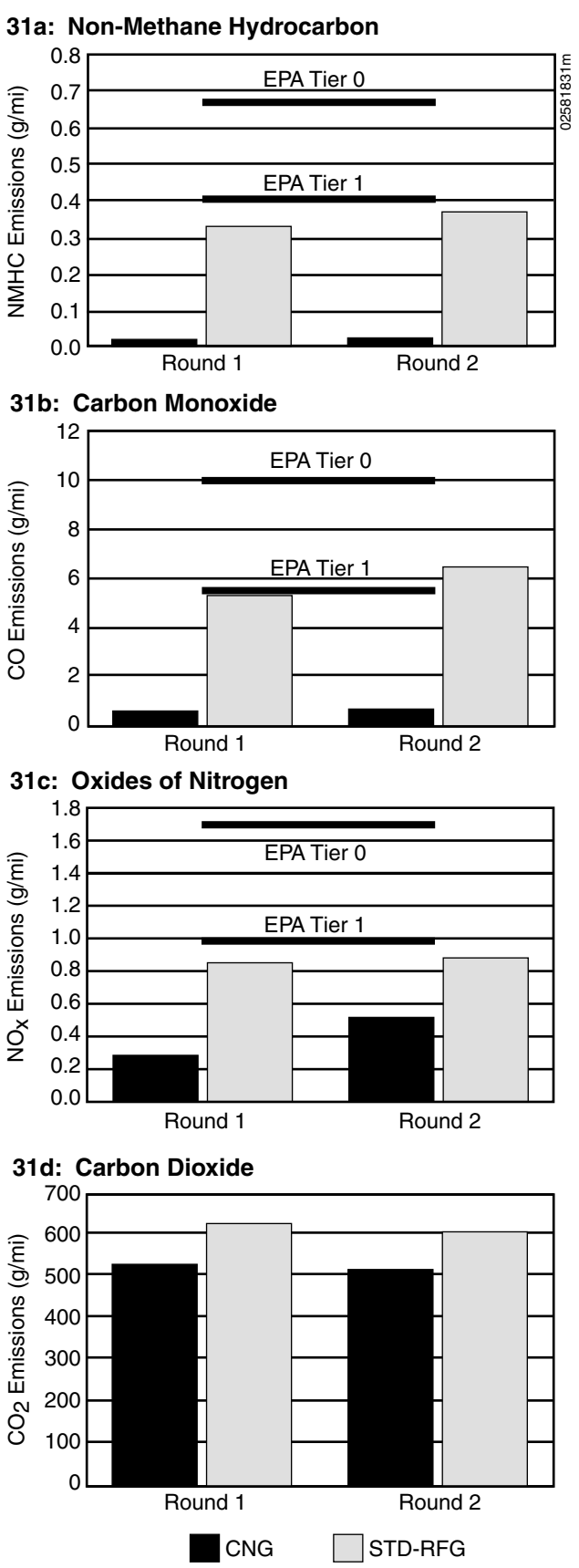

Figure 31. Emissions results from the Dodge B250 van tested at Lab 1

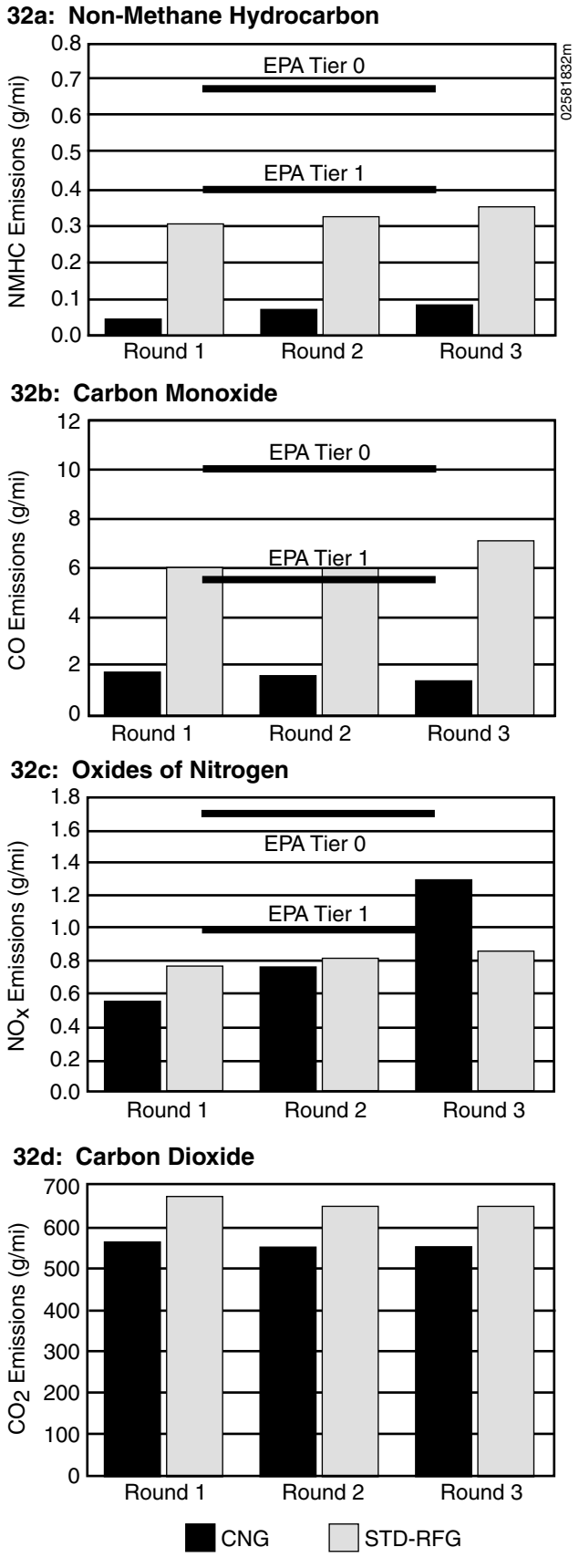

Figure 32. Emissions results from the Dodge B250 van tested at Lab 2

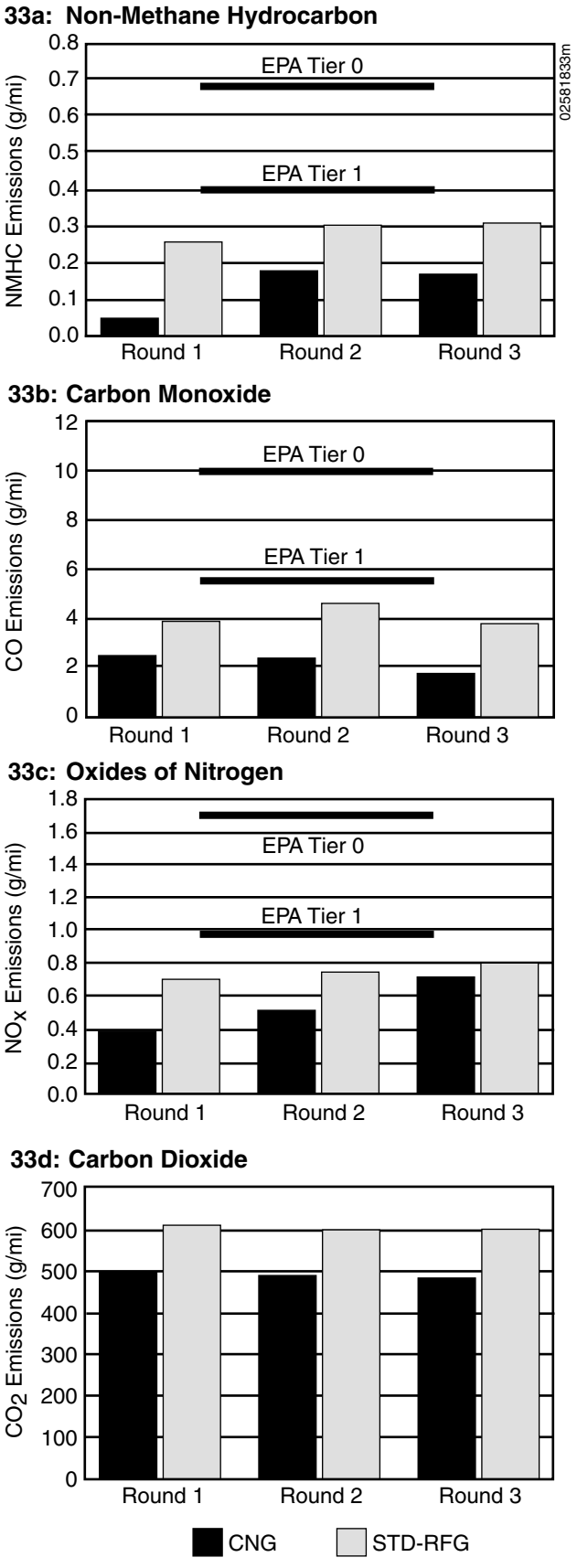

Figure 33. Emissions results from the Dodge B250 van tested at Lab 3

that tended to be significant. The differences between rounds for the RFG vans showed no significant difference at any of the labs.

Evaporative Emissions

CNG vehicles were designed with sealed fuel systems. To determine if the test vans were experiencing any leaks or "weepage" at any point in the natural gas fuel system, a modified evaporative test was performed. The gasoline vans received the standard evaporative test, which includes a heat build on the fuel tanks. The CNG vans were placed in the SHED for the two prescribed 1-hour tests, but without heating the tanks.

Average evaporative emissions for Labs 1, 2, and 3 are listed in Tables 35–37 and shown in Figures 34–36. The average evaporative emissions for the B250 van were well below the Tier 1 and Tier 0 limit of 2 g per test for all rounds at each lab. "Evaporative" HC emissions from the modified evaporative tests on the CNG vans were significantly lower than the evaporative emissions for the standard models for all labs during all test rounds. Evaporative emissions for the CNG vans tested at Lab 1 were 90% lower than those from the gasoline vans in Round 1 and 48.5% lower in Round 2. The CNG vans tested at Lab 2 showed larger differences of 35%, 61%, and 75% lower than the gasoline controls for Rounds 1, 2, and 3, respectively. Lab 3 also showed decreases for the CNG vans, from 43% to 62%. These differences tended to be statistically significant at the 95% confidence level.

Round-to-round comparisons showed significant increases for both fuels at Lab 1. The CNG vans at Lab 2 showed no significant difference between rounds and the control vans showed a steady increase in evaporative emissions that was only significant between Round 2 and Round 3. The CNG vans tested at Lab 3 also showed no significant difference between rounds. The evaporative emissions for the control vans at Lab 3 showed an increase in Round 2 and a decrease in Round 3. Neither of these differences, however, was statistically significant.

Greenhouse Gases

The average CO_2 emissions for the CNG vans were consistently lower than the average for the gasoline controls. Labs 1 and 2 showed a decrease of around 15% for all rounds. Lab 3 had a slightly higher percent decrease at approximately 19% for the 3 rounds. The differences in CO_2 emissions between CNG and RFG were statistically significant. The differences between rounds for both van types at all 3 labs tended not to be significant at the 95% confidence level.

Because CNG is 95% CH_4, emissions of this greenhouse gas are expected to be significantly higher for the CNG vans.

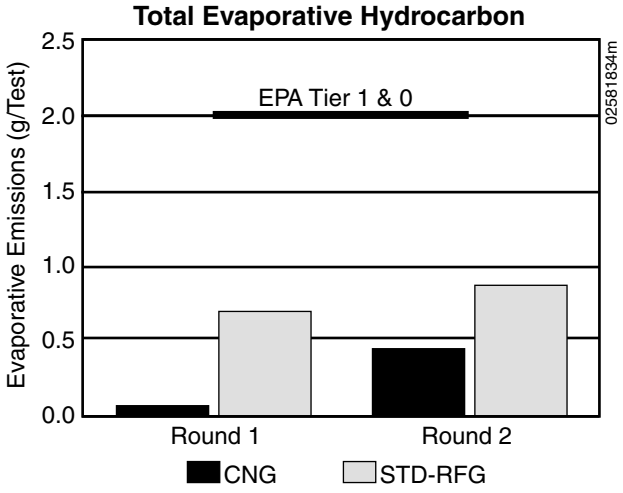

Figure 34. Evaporative emissions results from the Dodge B250 van tested at Lab 1

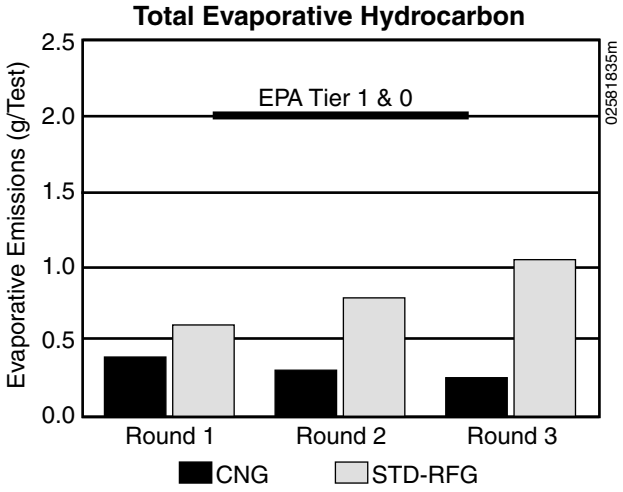

Figure 35. Evaporative emissions results from the Dodge B250 van tested at Lab 2

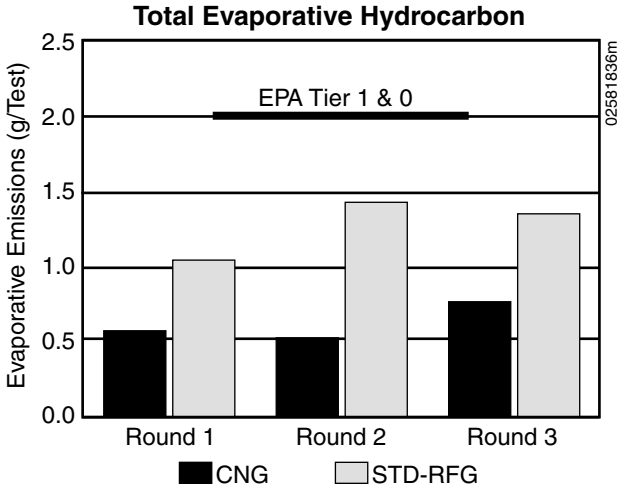

Figure 36. Evaporative emissions results from the Dodge B250 van tested at Lab 3

Differences in CH_4 emissions between the CNG tests and the RFG tests range from 245% higher to 1,387% higher. Round-to-round comparisons of CH_4 emissions at Labs 1 and 2 showed significant increases for the CNG tests over time. Lab 3 showed a significant increase in CH_4 for the CNG tests in Round 2, but no significant difference in Round 3. The RFG tests showed no significant difference in CH_4 emissions between rounds at any of the labs.

Aldehydes

Figures 37–39 present the average aldehyde emissions for the Dodge B250 vans at each lab. In general, aldehyde emissions from the CNG vans were much lower than those from the gasoline vans. The exception to this was the formaldehyde emissions at Lab 2. Labs 1 and 3 showed similar values between fuels for both formaldehyde and acetaldehyde with the CNG vans testing significantly lower than the gasoline control vans. Reductions in formaldehyde at Lab 1 were approximately 68% in Round 1 and 62% in Round 2. Lab 3 showed reductions in formaldehyde of approximately 54%, 53%, and 52% in Rounds 1, 2, and 3 respectively. Acetaldehyde emissions for the CNG vans at Lab 1 were 87% lower than those from the conventional vans in Round 1 and 81% lower in Round 2. Lab 3 showed similar reductions in acetaldehyde of 91% in Round 1 and 81% in Rounds 2 and 3.

Average formaldehyde emissions for the B250 vans tested at Lab 2 were not significantly different between fuels for the first 2 rounds. The CNG vans tested 9.9% higher than the gasoline controls in Round 1 and 5.4% lower in Round 2. Round 3, however, showed a significant increase in formaldehyde emissions for the CNG vans (51.8%). This could be due in part to the van mentioned earlier (on which the check engine light came on during the last phase of the FTP). The formaldehyde value for this van was considerably higher than that of the other vans tested. Removal of this value, which was not identified as an outlier, would reduce the percent difference to 26%, but the CNG average is still greater than that of the conventional model. Acetaldehyde emissions at Lab 2 agree with the other 2 labs, with the CNG vans testing significantly lower than the gasoline vans. The average acetaldehyde emissions for the CNG vans tested at Lab 2 were 78% lower than those from the conventional model van in Round 1, 76% lower in Round 2, and 75% lower in Round 3. The differences between rounds for aldehydes at all 3 labs tended to be not significant at the 95% confidence level.

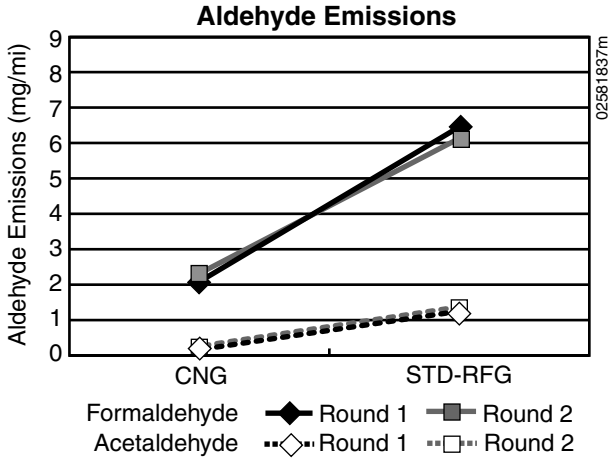

Figure 37. Aldehyde emissions from the Dodge B250 van tested at Lab 1

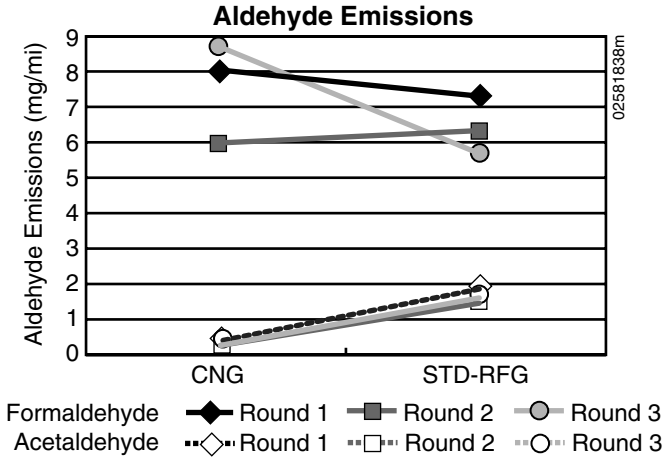

Figure 38. Aldehyde emissions from the Dodge B250 van tested at Lab 2

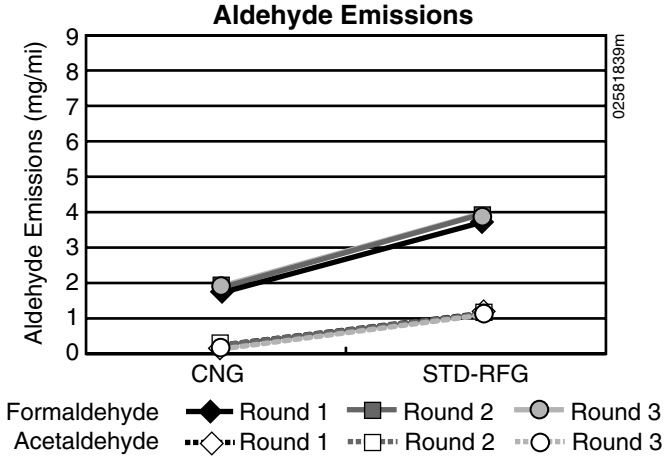

Figure 39. Aldehyde emissions from the Dodge B250 van tested at Lab 3

Table 38. Toxic Emissions from the Dodge B250 Van Tested at Lab 1

	CNG		STD-RFG		Percent Difference	Sig. Fuel Effect?
	Measured Value (mg/mi)	PWT	Measured Value (mg/mi)	PWT		
HCHO	1.878	0. 086	5.741	0.264	-67.4%	y
CH_3CHO	0.152	0.001	1.167	0.009	-88.9%	y
1,3-butadiene	0	0	2.1	2.1	-100.0%	y
Benzene	0.060	0.0018	14.15	0.425	-99.6%	y
Total	2.09	0.089	23.16	2.798	-96.8%	y

Table 39. Toxic Emissions from the Dodge B250 Van Tested at Lab 3

	CNG		STD-RFG		Percent Difference	Sig. Fuel Effect?
	Measured Value (mg/mi)	PWT	Measured Value (mg/mi)	PWT		
HCHO	2.007	0.092	3.467	0.159	-42.1%	y
CH_3CHO	0.171	0.0014	0.989	0.0079	-82.3%	y
1,3-butadiene	0.014	0.014	1.985	1.985	-99.3%	y
Benzene	0.25	0.0075	11.179	0.335	-97.8%	y
Total	2.442	0.115	17.62	2.488	-95.4%	y

Potency-Weighted Toxics and Ozone-Forming Potential

Hydrocarbon speciation was performed on a percentage of the Dodge B250 vans at Labs 1 and 3. Four CNG and three gasoline control vans speciated at Lab 1. The vans receiving full speciation at Lab 3 totaled four CNG and five gasoline control vans.

Tables 38 and 39 present the comparisons between van models for PWT emissions at Labs 1 and 3, respectively. Figures 40 and 41 show the results graphically. The aldehyde averages listed include the results for only those vehicles that were speciated. These results show a significant advantage in using CNG fuel over gasoline. All the toxics for the CNG vans tested at Lab 1 were significantly lower than the averages for the RFG tests. Lab 1 reported no 1,3-butadiene present in the CNG tests, which represented a 100% decrease over the RFG levels. Total PWT for the CNG vans was 96.8% lower than that of the gasoline control vans. Lab 3 showed agreement with Lab 1. All toxics for the CNG vans were significantly lower than the gasoline controls. Total PWT for the CNG vans was 95.4% lower than that of the gasoline controls.

Tables 40 and 41 present the NMOG, OFP, and SR results for the Dodge B250 vans. Average NMOG for the CNG vans was significantly lower than the average for the gasoline models. The OFP and SR results are graphically presented in Figures 42 and 43. OFP from the CNG vans was significantly lower than that from the gasoline vans by 96.5% at Lab 1 and 81% at Lab 3. SR also showed significant reductions for the CNG vans, approximately 46% at Lab 1 and 56% at Lab 3.

Fuel Economy

Because CNG is a gaseous fuel, it must be converted to gallons of gasoline equivalent (gge) in order to make a comparison with a liquid fuel. An equivalent gallon of CNG is the quantity of CNG that has the same energy content as a gallon of gasoline. A gallon of RFG has 111,960 Btu. Approximately 121 standard cubic foot (scf) of test CNG contains the same Btu as RFG. Therefore, 121 scf equals one gge.

Fuel economy averages for the CNG van are listed in Tables 35–37 as miles per equivalent gallon of gasoline. Average fuel economy for the CNG Dodge B250 vans was only slightly less than that of the conventional models. All three labs were in

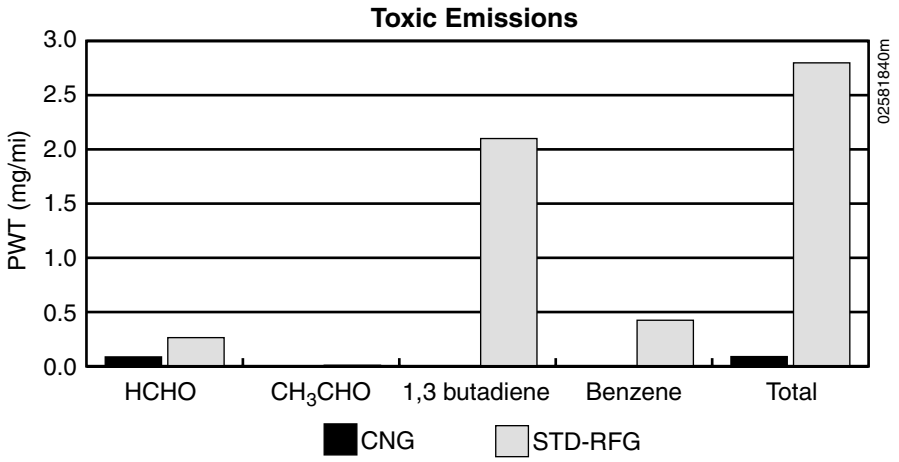

Figure 40. PWT emissions from the Dodge B250 van tested at Lab 1

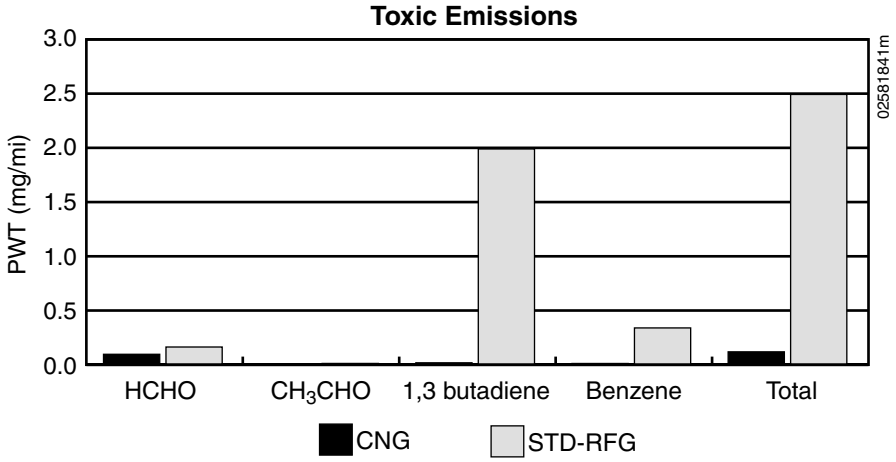

Figure 41. PWT emissions for the Dodge B250 van tested at Lab 3

Table 40. OFP for the Dodge B250 van Tested at Lab 1

	CNG	STD-RFG	Percent Difference	Sig. Fuel Effect?
NMOG (mg/mi)	21.95	354.49	-93.8%	y
OFP (mg O_3/mi)	45.2	1,305.31	-96.5%	y
SR (mg O_3/mg NMOG)	2.06	3.836	-46.3%	y

Table 41. OFP for the Dodge B250 Van Tested at Lab 3

	CNG	STD-RFG	Percent Difference	Sig. Fuel Effect?
NMOG (mg/mi)	76.48	308.72	-75.2%	y
OFP (mg O_3/mi)	233.27	1208.9	-80.7%	y
SR (mg O_3/mg NMOG)	1.768	4.031	-56.1%	y

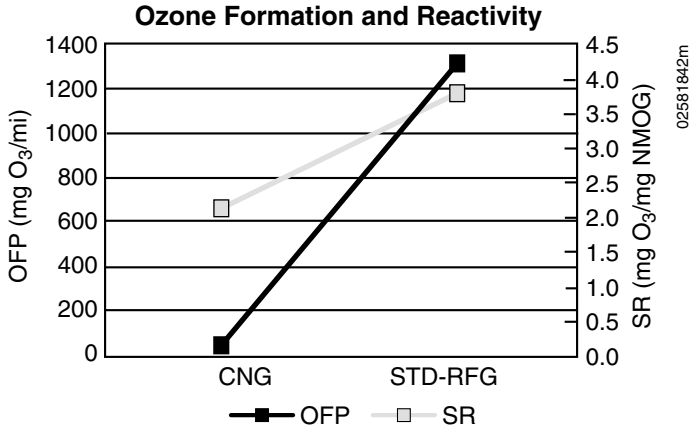

Figure 42. OFP and SR for the Dodge B250 van tested at Lab 1

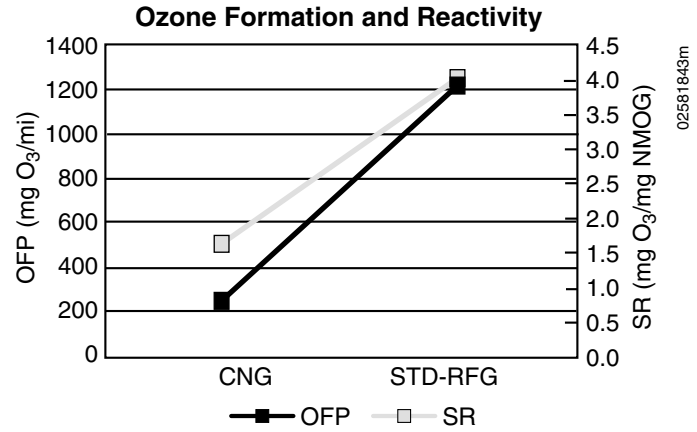

Figure 43. OFP and SR for the Dodge B250 van tested at Lab 3

agreement, with percent differences ranging from 2% lower in the CNG vans to approximately 12% lower. These differences in fuel economy between CNG and RFG were significant for all rounds at all 3 labs.

Dodge Caravan Minivan

The 1994 Dodge Caravan is a minivan equipped with a 3.3 L V6 engine (Figure 44). Both models were certified to EPA Tier 1 emissions levels. Because there was a limited number of vehicles available, these vans were only tested in one round. There were 13 dedicated CNG vans and 6 standard gasoline vans tested. Mileage ranges and average odometer readings for the Caravans tested in this program are listed in Table 42. Detailed hydrocarbon speciation was not performed on these vehicles.

Regulated Emissions

Table 43 lists the average emissions for the CNG and conventional model Caravans along with the percent differences and an indication of whether the differences are statistically significant at the 95% confidence level. Figure 45 shows the comparison of average regulated emissions and CO_2 for these vans. All regulated emissions results for the Caravans were well below the EPA Tier 1 standard. When comparing regulated emissions for the CNG Caravan to those of the gasoline control vans, there was a sig-

Table 42. Odometer Readings for the Dodge Caravan Minivan

	CNG	Gasoline
No. vehicles tested	6	13
Odometer (miles)		
Average	17,888	6,683
Maximum	20,696	14,282
Minimum	15,527	3,817

Warren Gretz, NREL/PIX02487

Figure 44. The 1994 CNG Dodge Caravan minivan

Table 43. Average Emissions Results from the Dodge Caravan Minivan

	Round 1			
	CNG	STD-RFG	Percent Difference	Sig. Fuel Effect?
Regulated Emissions (g/mi)				
NMHC	0.022	0.147	-84.8%	y
THC	0.166	0.169	-2.1%	n
CO	0.364	1.552	-76.5%	y
NO_x	0.187	0.296	-36.9%	n
Evaporative Emissions (g/test)				
Total Evaporative	0.311	0.323	-3.7%	n
Greenhouse Gases (g/mi)				
CO_2	389.54	467.22	-16.6%	y
CH_4	0.142	0.028	415.0%	y
Aldehydes (mg/mi)				
HCHO	4.036	3.468	16.4%	n
CH_3CHO	0.322	0.902	-64.3%	y
Fuel Economy				
Fuel Economy	17.45	18.84	-7.3%	y

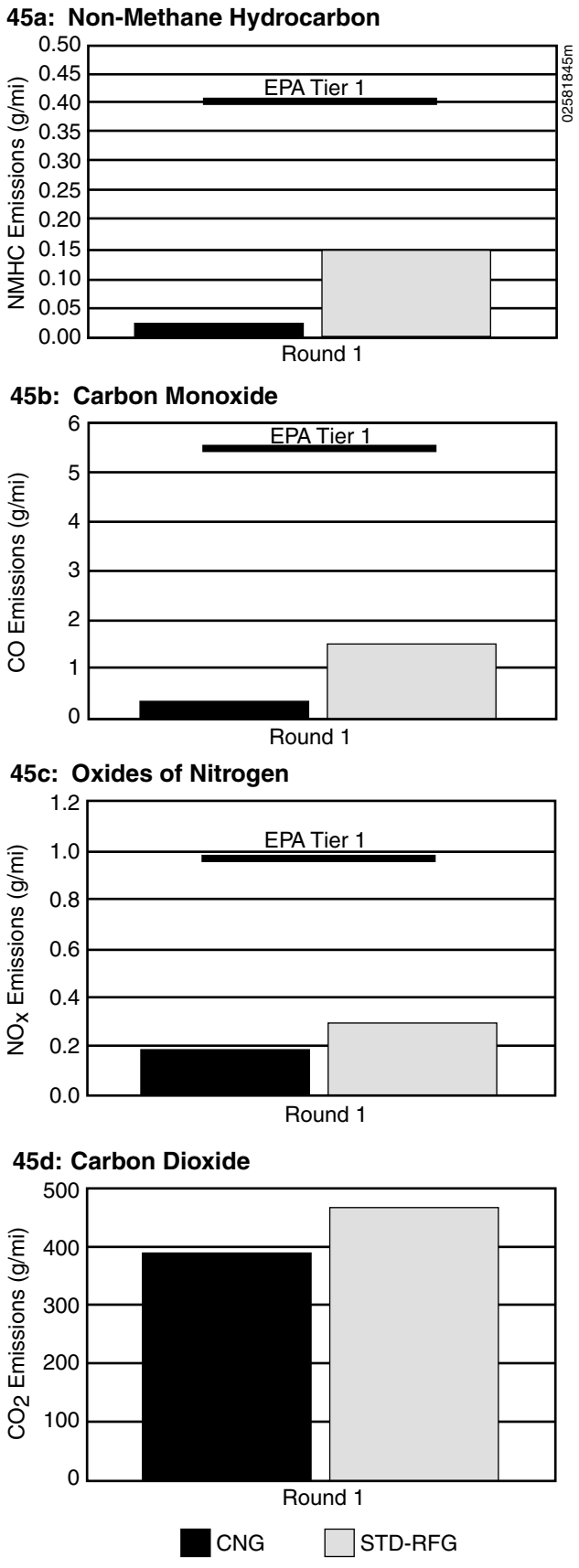

Figure 45. Emissions results from the Dodge Caravan minivan

nificant decrease in NMHC, a significant decrease in CO, and a decrease in NO_x that was not significant at the 95% confidence level. NMHC was 85% lower for the CNG model. CO emissions were 76.5% lower and NO_x emissions were 37% lower for the CNG vans.

Evaporative Emissions

The same modified evaporative emissions test described in the section on the B250 vans was performed on the CNG Dodge Caravans. Results for the Dodge Caravans are listed in Table 36 and graphically illustrated in Figure 46. Average "evaporative" emissions for both CNG and gasoline models were well below the Tier 0 and Tier 1 limit of 2 g. As with the B250 van, the CNG Caravan emitted measurable HC during the test, but they were lower than the average evaporative emissions from the gasoline control. The reduction was 3.7%, which was not statistically significant at the 95% confidence level.

Greenhouse Gases

As with the regulated emissions, average CO_2 emissions were significantly lower for the CNG Caravans. Values for the CNG vans were approximately 16% lower than those of their gasoline counterparts. Average CH_4 emissions, as expected, were higher for the CNG Caravans. Although the values for each van type were quite low, the CNG model showed a 415% increase in CH_4 over the gasoline model.

Aldehydes

Aldehyde emissions levels for the Dodge Caravans are shown in Figure 47. Although the formaldehyde emissions from the CNG minivans were 16% higher than the gasoline model, this difference was not statistically significant at the 95% confidence level. Acetaldehyde emissions were 64% lower for the

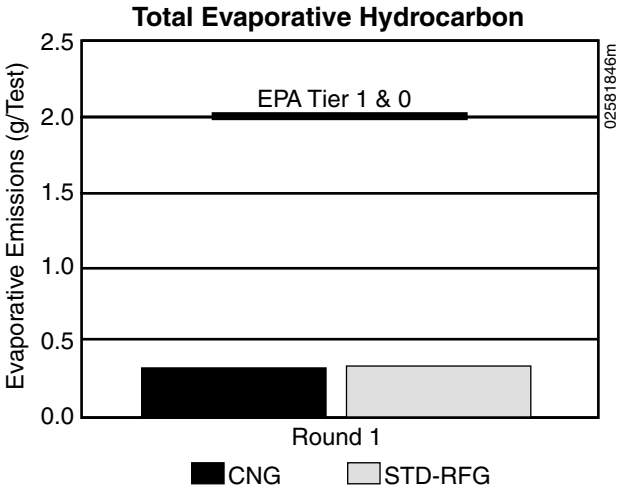

Figure 46. Evaporative emissions results from the Dodge Caravan minivan

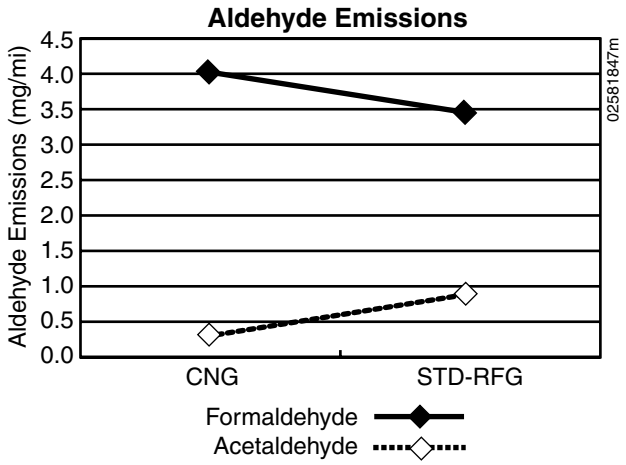

Figure 47. Aldehyde emissions from the Dodge Caravan minivan

CNG model compared to the RFG results.

Fuel Economy

Fuel economy comparisons for the Dodge Caravan showed very little difference when compared on a gasoline gallon equivalent between the CNG and standard models. The fuel economy for the CNG minivans was approximately 7% lower than that of the standard gasoline model.

SUMMARY

In conclusion, these tests showed that, overall, there are emissions advantages to using alternative fuel over gasoline. The following points summarize the comparison between each alternative fuel and gasoline.

METHANOL VEHICLES

- NMHCE was significantly lower in M85 tests for both the Intrepid and Spirit.
- CO emissions were slightly higher for the M85 tests on the Intrepid and lower for the M85 tests on the Spirit. These differences, however, tended not to be significant at the 95% confidence level.
- NO_x emissions tended to be significantly higher in the M85 tests for both FFV models.
- Greenhouse gases (CO_2 and CH_4) were significantly lower in the M85 tests for both FFV models.
- Formaldehyde was significantly increased for the M85 tests, but acetaldehyde was significantly decreased.
- Benzene and 1,3-butadiene levels were significantly lower for the M85 tests.
- Evaporative results were varied, but tended not to be significant at the 95% confidence level.
- PWT, OFP, and SR were all significantly lower in the M85 tests for both FFV models.

ETHANOL VEHICLES

- Regulated emissions for the Taurus showed no significant difference between fuels.
- Regulated emissions results for the Lumina were mixed: NMHCE tended not to be significant between fuels, CO emissions were higher (but not significantly) for the E85 tests, and NO_x emissions were significantly lower for the E85 tests.
- CO_2 emissions were significantly lower for the tests on E85 for both FFV models.
- CH_4 emissions were significantly higher for the tests on E85 for both FFV models.
- Formaldehyde and acetaldehyde emissions were significantly higher for the tests on E85 for both FFV models.
- Benzene and 1,3-butadiene levels were significantly lower for the E85 tests.
- Evaporative emissions for the ethanol FFVs tended to show no significant difference between fuels.
- PWT and SR were significantly lower for the E85 tests on the FFV Taurus.
- OFP was significantly higher for the E85 tests on the FFV Taurus.

CNG VEHICLES

- NMHC emissions for the CNG models were significantly lower than those of the gasoline vehicles.
- CO emissions were significantly lower for the CNG vans.
- NO_x emissions results were mixed, but tended to be significantly lower for the CNG tests.
- CO_2 emissions were significantly lower for the CNG tests.
- CH_4 emissions were significantly higher for the CNG tests.
- Formaldehyde emissions tended to be significantly lower for the CNG tests.
- Acetaldehyde emissions from the CNG vehicles were significantly lower than the gasoline tests.
- Evaporative emissions results were significantly lower for the CNG tests.
- PWT, OFP, and SR were significantly lower for the CNG tests.

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Appendix A:
Emissions Data Sets

Table A-1. 1995 Standard Dodge Intrepid : RFG Tests at Lab 1 Round 1

Decal ID	Test Date	Odometer	Fuel	MPG	CH_3CHO	CH_3OH	CH_4	CO	CO_2	HCHO	NMHCE	NO_x	THC	Evap. THC
AR304GNC	7/12/95	3336	RFG	19.22	0.00036		0.019	0.78	451.8	0.0015	0.09	0.18	0.105	0.334
AR305GNC	6/21/95	3906	RFG	19.34	0.0003		0.028	1.07	448.2	0.00188	0.109	0.16	0.131	0.368
AR306GNC	7/18/95	3853	RFG	19.43	0.00036		0.021	0.59	447.1	0.0021	0.086	0.2	0.103	0.173
AR307GNC	6/9/95	3576	RFG	19.23	0.00035		0.024	0.72	451.6	0.00164	0.093	0.19	0.112	0.437
AR308GNC	6/9/95	3869	RFG	19.61	0.00034		0.026	0.82	442.6	0.00167	0.096	0.21	0.117	1.103
AR309GNC	9/28/95	4196	RFG	19.08	0.00039		0.022	0.98	454.5	0.00217	0.105	0.14	0.123	0.492
AR310GNC	6/21/95	3681	RFG	19.44	0.00034		0.024	0.67	446.7	0.00186	0.092	0.14	0.111	0.369
AR311GNC	6/13/95	3740	RFG	19.34	0.00039		0.019	0.76	448.8	0.00173	0.097	0.12	0.112	1.069
AR312GNC	7/18/95	6293	RFG	19.78	0.0004		0.02	0.81	438.7	0.0016	0.096	0.17	0.112	0.397
AR313GNC	1/25/96	3435	RFG	19.07	0.00041		0.028	0.94	454.8	0.0015	0.131	0.1	0.153	1.381
DT301GNC	9/27/95	4648	RFG	19.1	0.00035		0.022	0.77	454.3	0.00196	0.103	0.11	0.121	0.374
DT302GNC	11/3/95	10056	RFG	19.4	0.00025		0.022	0.75	447.4	0.00113	0.113	0.19	0.131	†
DT302GNC	11/21/95	10103	RFG	19.06	0.0004		0.024	0.86	455.2	0.00141	0.107	0.23	0.126	0.353
Average				19.23	0.000325		0.023	0.805	451.3	0.00137	0.11	0.21	0.1285	0.353
DT303GNC	11/9/95	4879	RFG	19.5	0.00031		0.022	0.93	444.8	0.00163	0.113	0.13	0.131	†
DT305GNC	10/31/95	5960	RFG	19.28	0.00036		0.024	1	449.8	0.00187	0.111	0.14	0.13	†
DT306GNC	10/31/95	7007	RFG	19.26	0.00038		0.028	1.03	450.2	0.00199	0.116	0.19	0.139	†
DT308GNC	11/21/95	5021	RFG	18.68	0.00037		0.021	0.81	464.6	0.00135	0.102	0.12	0.118	1.04
DT309GNC	12/23/95	18783	RFG	19.66	0.00057		0.028	0.97	440.9	0.00207	0.132	0.18	0.154	0.249
	COUNT			17	16		17	17	17	17	17	17	17	14
	AVG			19.309	0.000358		0.0235	0.8503	449.45	0.00176	0.1048	0.1582	0.1236	0.5813
	STD DEV			0.2596	0.000031		0.00316	0.135	6.0915	0.00025	0.0132	0.0359	0.0150	0.387
	CV			0.0134	0.08729		0.1348	0.1587	0.0135	0.1443	0.1263	0.2270	0.1217	0.6656

Table A-2. 1995 FFV Dodge Intrepid: M85 Tests at Lab 1 Round 1

Decal ID	Test Date	Odometer	Fuel	MPG	CH_3CHO	CH_3OH	CH_4	CO	CO_2	HCHO	NMHCE	NO_x	THC	Evap. THC
AR304MN	7/19/95	4559	M85	11.47	0.00019	0.1245	0.015	0.86	420.6	0.01497	0.083	0.3	0.087	0.808
AR305MN	9/18/95	3368	M85	10.84	0.00014	0.1966	0.015	0.99	444.8	0.01553	0.105	0.48	0.11	1.036
AR306MN	9/14/95	3139	M85	11.38	0.00018	0.1834	0.013	0.96	423.8	0.01501	0.097	0.38	0.1	0.851
AR307MN	9/22/95	3642	M85	11.05	0.00015	0.2162	0.013	1.09	436.3	0.0165	0.115	0.37	0.118	0.698
AR308MN	9/25/95	6191	M85	10.99	0.00012	0.2434	0.016	1.43	438.1	0.01371	0.128	0.34	0.134	0.669
AR310MN	10/6/95	4099	M85	11.57	0.00023	0.17	0.018	0.96	416.8	0.02154	0.102	0.37	0.107	1.02
AR311MN	11/7/95	3047	M85	11.71	0.00012	0.1517	0.014	1.04	411.8	0.01467	0.101	0.27	0.106	0.895
AR312MN	11/6/95	9558	M85	11.32	0.00016	0.1718	0.017	1.09	425.9	0.01849	0.117	0.41	0.122	0.793
AR313MN	11/3/95	3970	M85	11.87	0.00015	0.1604	0.017	0.94	406.4	0.01559	0.113	0.32	0.119	0.922
AR314GNC	2/9/96	5924	M85	12.1	0.00021	0.2111	0.019	0.97	398.6	0.0168	0.11	0.3	0.117	0.998
AR314MN	11/2/95	7230	M85	11.8	0.00014	0.1447	0.017	0.98	408.8	0.01406	0.092	0.31	0.099	1.067
AR317MN	1/24/96	4854	M85	11.82	0.00017	0.2231	0.017	1.18	407.7	0.01552	0.108	0.35	0.115	0.585
AR318MN	1/30/96	8062	M85	12.1	0.00017	0.2475	0.017	1.17	398.3	0.01679	0.117	0.25	0.117	0.952
AR319MN	2/8/96	4828	M85	12.19	0.00021	0.2309	0.016	0.95	395.6	0.01669	0.116	0.25	0.121	1.203
AR320MN	2/27/96	6068	M85	12.29	0.00019	0.1873	0.015	0.98	392.2	0.01278	0.097	0.27	0.103	0.84
AR322MN	4/29/96	3516	M85	12.12	0.00019	0.2214	0.017	0.99	397.6	0.01737	0.118	0.28	0.124	0.677
	COUNT			16	16	16	16	15	16	16	16	16	16	16
	AVG			11.664	0.00017	0.1928	0.016	1.01	413.96	0.016	0.1074	0.3281	0.1124	0.8759
	STD DEV			0.455	0.000032	0.0369	0.0017	0.088	16.353	0.0021	0.0116	0.0632	0.0116	0.1684
	CV			0.039	0.1909	0.1915	0.1070	0.087	0.0395	0.1296	0.1079	0.1925	0.1036	0.1922

Table A-3. 1995 FFV Dodge Intrepid: RFG Tests at Lab 1 Round 1

Decal ID	Test Date	Odometer	Fuel	MPG	CH_3CHO	CH_3OH	CH_4	CO	CO_2	HCHO	NMHCE	NO_x	THC	Evap. THC
AR304MN	7/11/95	4373	RFG	19.12	0.00039		0.026	0.84	453.9	0.00188	0.116	0.14	0.137	0.337
AR304MN	7/18/95	4532	RFG	18.82	0.00043		0.023	0.92	461.1	0.0022	0.119	0.17	0.138	1.142
Average				18.97	0.00041		0.0245	0.88	457.5	0.00204	0.1175	0.155	0.1375	0.7395
AR305MN	9/15/95	3342	RFG	18.65	0.00025		0.025	0.85	465.5	0.00165	0.108	0.32	0.128	0.791
AR306MN	9/13/95	3112	RFG	18.6	0.00043		0.023	1.02	466.3	0.00189	0.118	0.2	0.137	0.846
AR307MN	9/25/95	3669	RFG	18.81	0.00084		0.022	0.99	461.1	0.00193	0.122	0.27	0.139	0.508
AR308MN	9/22/95	6164	RFG	18.65	0.00057		0.025	0.9	465	0.00213	0.176	0.18	0.196	0.404
AR310MN	10/5/95	4072	RFG	19.11	0.00028		0.036	0.84	454	0.00187	0.11	0.46	0.139	0.81
AR311MN	11/6/95	3020	RFG	17.95	0.00036		0.027	1.26	482.6	0.00195	0.143	0.33	0.165	0.955
AR312MN	11/3/95	9531	RFG	19.99	0.00044		0.028	1.05	433.5	0.00247	0.138	0.25	0.16	0.548
AR313MN	11/2/95	3943	RFG	19.08	0.00035		0.031	0.82	454.6	0.00186	0.125	0.21	0.15	0.564
AR314GNC	2/8/96	5898	RFG	19.77	0.00046		0.028	1.01	438.5	0.00163	0.14	0.18	0.162	0.716
AR314MN	10/31/95	7176	RFG	19.67	0.0003		0.032	0.85	441.1	0.00158	0.083	0.25	0.108	0.74
AR317MN	1/23/96	4827	RFG	18.97	0.00048		0.031	1.18	456.9	0.00184	0.117	0.36	0.142	0.476
AR318MN	1/31/96	8098	RFG	19.87	0.00055		0.032	1.21	436	0.00194	0.138	0.22	0.163	0.665
AR319MN	2/9/96	4854	RFG	19.96	0.00043		0.027	0.88	434.5	0.00178	0.127	0.2	0.148	0.882
AR320MN	2/26/96	6041	RFG	18.82	0.00047		0.027	1.17	460.5	0.00171	0.132	0.16	0.153	0.618
AR322MN	4/26/96	3490	RFG	20.19	0.00053		0.028	0.85	429.6	0.00213	0.138	0.18	0.161	0.449
	COUNT			16	16		16	15	16	16	16	16	16	16
	AVG			19.191	0.00045		0.0279	0.991	452.325	0.0019	0.127	0.245	0.149	0.6695
	STD DEV			0.6391	0.00014		0.0037	0.1533	15.095	0.00022	0.0202	0.0844	0.0196	0.166
	CV			0.033	0.3144		0.1335	0.1548	0.0334	0.1177	0.1588	0.3441	0.1313	0.2486

Table A-4. 1995 Standard Dodge Intrepid: RFG Tests at Lab 1 Round 2

Decal ID	Test Date	Odometer	Fuel	MPG	CH_3CHO	CH_3OH	CH_4	CO	CO_2	HCHO	NMHCE	NO_x	THC	Evap. THC
AR304GNC	8/6/96	14546	RFG	20.48	0.00051		0.026	1.06	423.8	0.00196	0.124	0.15	0.145	0.35
AR304GNC	8/7/96	14596	RFG	20.81	0.00076		0.021	0.78	417.4	0.00198	0.116	0.14	0.133	0.358
Average				20.645	0.000635		0.0235	0.92	420.6	0.00197	0.12	0.145	0.139	0.354
AR305GNC	9/26/96	15883	RFG	20.24	0.00052		0.03	1.19	428.7	0.00229	0.124	0.3	0.148	0.471
AR305GNC	10/3/96	15941	RFG	20.89	0.00045		0.023	1.06	415.5	0.00185	0.124	0.18	0.142	0.632
Average				20.565	0.000485		0.0265	1.125	422.1	0.00207	0.124	0.24	0.145	0.5515
AR306GNC	6/3/96	11116	RFG	20.4	0.00064		0.025	0.8	425.9	0.00252	0.105	0.21	0.125	1.464
AR307GNC	6/3/96	16746	RFG	20.42	0.0006		0.027	0.85	425.3	0.00239	0.129	0.14	0.15	0.637
AR308GNC	9/26/96	19953	RFG	20.45	0.00055		0.03	1.05	424.5	0.00231	0.129	0.21	0.152	0.386
AR309GNC	7/18/96	15745	RFG	20.19	0.00074		0.025	1.14	429.7	0.00273	0.146	0.21	0.165	0.394
AR310GNC	8/2/96	14018	RFG	19.82	0.00059		0.024	1.03	437.9	0.00215	0.121	0.16	0.14	0.523
AR311GNC	6/3/96	20662	RFG	20.78	0.00064		0.03	1.18	417.5	0.00261	0.137	0.13	0.161	0.377
AR312GNC	7/26/96	13840	RFG	20.05	0.00056		0.024	1.05	433	0.00222	0.125	0.17	0.144	0.365
AR313GNC	7/1/96	5929	RFG	19.53	0.00051		0.026	0.81	444.9	0.00203	0.142	0.1	0.163	1.008
DT301GNC	7/1/96	13201	RFG	19.86	0.00048		0.023	0.9	437.4	0.00202	0.122	0.17	0.141	0.272
DT302GNC	7/26/96	25765	RFG	22.58	0.00061		0.022	1.03	384.3	0.00245	0.119	0.1	0.137	0.378
DT303GNC	9/4/96	12494	RFG	20.265	0.000425		0.0215	0.865	428.75	0.00179	0.114	0.14	0.131	0.872
DT305GNC	7/22/96	15174	RFG	20.49	0.00069		0.027	0.98	423.7	0.00257	0.141	0.16	0.162	0.265
DT306GNC	7/22/96	21941	RFG	20.27	0.0007		0.028	1.16	428	0.00272	0.153	0.17	0.175	1.242
DT308GNC	9/3/96	13177	RFG	20.04	0.00044		0.023	0.91	433.4	0.00168	0.106	0.24	0.125	0.339
DT308GNC	9/4/96	13196	RFG	20.04	0.00034		0.024	0.92	433.5	0.00163	0.099	0.24	0.119	0.238
Average				20.04	0.00039		0.0235	0.915	433.45	0.001655	0.1025	0.24	0.122	0.2885
DT309GNC	10/17/96	42738	RFG	21.23	0.00063		0.032	1.13	408.5	0.00266	0.145	0.26	0.171	0.418
	COUNT			16	17		17	17	17	17	17	17	17	17
	AVG			20.313	0.00058		0.0258	0.9961	425.03	0.00229	0.1279	0.1738	0.1484	0.5762
	STD DEV			0.4103	0.000097		0.00297	0.1269	13.491	0.00033	0.0144	0.0477	0.0158	0.3581
	CV			0.0202	0.1676		0.1152	0.1273	0.0317	0.1448	0.1126	0.2747	0.1064	0.6216

Table A-5. 1995 FFV Dodge Intrepid: M85 Tests at Lab 1 Round 2

Decal ID	Test Date	Odometer	Fuel	MPG	CH_3CHO	CH_3OH	CH_4	CO	CO_2	HCHO	NMHCE	NO_x	THC	Evap. THC
AR304MN	6/20/96	26084	M85	12.57	0.00027	0.1641	0.019	1.24	382.9	0.02224	0.133	0.24	0.138	1.101
AR305MN	7/11/96	9653	M85	11.95	0.0002	0.1989	0.016	1.12	403.2	0.01641	0.132	0.3	0.137	0.886
AR306MN	10/8/96	10593	M85	12.34	0.00021	0.2389	0.015	1.21	390.2	0.01559	0.117	0.3	0.121	0.964
AR307MN	6/20/96	12658	M85	12.44	0.00026	0.2004	0.017	1.33	386.8	0.01952	0.142	0.36	0.146	0.64
AR308MN	7/5/96	16646	M85	11.99	0.00032	0.2016	0.016	1.08	402	0.02111	0.141	0.28	0.144	0.832
AR310MN	7/26/96	10221	M85	12.2	0.00027	0.1962	0.018	1.1	394.8	0.01788	0.123	0.29	0.129	0.521
AR311MN	1/29/97	10035	M85	11.68	0.00027	0.2366	0.018	1.2	408.6	0.01543	0.124	0.25	0.13	0.549
AR312MN	7/9/96	21441	M85	12.11	0.00024	0.1942	0.016	1.16	397.7	0.02006	0.133	0.31	0.137	0.875
AR313MN	9/27/96	13177	M85	12.03	0.00024	0.2519	0.017	1.07	400.5	0.01815	0.132	0.26	0.138	0.57
AR314GNC	1/6/97	12431	M85	12.31	0.0002	0.2409	0.017	1.07	387.8	0.01687	0.125	0.25	0.13	0.726
AR314GNC	1/7/97	12450	M85	12.31	0.00024	0.2186	0.018	1.02	388.2	0.01665	0.109	0.27	0.115	0.666
Average				12.31	0.00022	0.22975	0.0175	1.045	388	0.01676	0.117	0.26	0.1225	0.696
AR314MN	6/6/96	14862	M85	12.53	0.00023	0.1934	0.016	1.09	384.7	0.01831	0.105	0.26	0.11	0.835
AR317MN	10/30/96	18285	M85	12	0.00021	0.2538	0.016	1.13	401.7	0.01625	0.123	0.29	0.119	0.761
AR317MN	11/27/96	18476	M85	11.68	0.00017	0.2395	0.021	1.68	408	0.01645	0.122	0.31	0.131	0.72
Average				11.84	0.00019	0.24665	0.0185	1.405	404.85	0.01635	0.1225	0.3	0.125	0.7405
AR318MN	12/13/96	18284	M85	11.86	0.0002	0.2187	0.019	1.13	402.6	0.01881	0.128	0.3	0.134	1.242
AR319MN	12/23/96	9818	M85	12.24	0.00018	0.2916	0.018	1.06	390.3	0.01652	0.145	0.32	0.134	0.983
AR319MN	1/3/97	9837	M85	12.06	0.00022	0.2654	0.017	1.05	396	0.01734	0.133	0.33	0.138	0.948
Average				12.15	0.0002	0.2785	0.0175	1.055	393.15	0.01693	0.139	0.325	0.136	0.9655
AR320MN	11/4/96	14261	M85	12.54	0.00018	0.2241	0.017	1.04	380.8	0.0151	0.117	0.2	0.123	0.825
AR320MN	11/5/96	14280	M85	12.08	0.00015	0.233	0.017	1.03	395.5	0.01517	0.123	0.23	0.128	0.804
Average				12.31	0.000165	0.22855	0.017	1.035	388.15	0.015135	0.12	0.215	0.1255	0.8145
AR322MN	2/3/97	10855	M85	12.17	0.00022	0.2421	0.019	1.24	392.2	0.0133	0.128	0.27	0.137	0.831
	COUNT			16	16	16	16	15	16	16	16	16	16	16
	AVG			12.155	0.000232	0.220	0.0173	1.162	395.02	0.0176	0.1273	0.2825	0.1319	0.8164
	STD DEV			0.2553	0.000039	0.0291	0.00125	0.1085	7.9310	0.00234	0.0099	0.0355	0.0093	0.1977
	CV			0.0210	0.1694	0.1321	0.0724	0.0934	0.0201	0.1338	0.0777	0.1258	0.0708	0.2421

Table A-6. 1995 FFV Dodge Intrepid: RFG Tests at Lab 1 Round 2

Decal ID	Test Date	Odometer	Fuel	MPG	CH_3CHO	CH_3OH	CH_4	CO	CO_2	HCHO	NMHCE	NO_x	THC	Evap. THC
AR304MN	6/21/96	26110	RFG	20.42	0.00086		0.038	1.59	424.1	0.00359	0.192	0.23	0.222	1.682
AR305MN	7/5/96	9599	RFG	20.04	0.00049		0.03	1.06	433	0.0021	0.182	0.21	0.206	0.776
AR306MN	10/3/96	10566	RFG	20.5	0.00054		0.029	1.29	422.9	0.00254	0.159	0.23	0.182	0.547
AR307MN	6/19/96	12632	RFG	20.64	0.00084		0.031	1.36	419.7	0.0034	0.2	0.28	0.225	0.455
AR308MN	7/9/96	15673	RFG	19.45	0.00063		0.029	1.25	445.9	0.00257	0.167	0.22	0.189	0.547
AR310MN	7/25/96	10194	RFG	19.99	0.00071		0.036	1.02	434.1	0.00261	0.133	0.39	0.161	1.017
AR311MN	1/30/97	10062	RFG	19.67	0.00058		0.031	1.18	441.2	0.00231	0.151	0.25	0.175	0.461
AR312MN	7/5/96	21414	RFG	20.61	0.00068		0.032	1.26	420.7	0.00276	0.181	0.22	0.207	0.559
AR313MN	9/26/96	13151	RFG	20.32	0.00059		0.033	0.99	427.1	0.00263	0.156	0.21	0.182	0.361
AR314GNC	12/11/96	12339	RFG	20.1	0.0005		0.031	1.18	431.5	0.00226	0.167	0.18	0.192	0.666
AR314GNC	12/12/96	12378	RFG	19.97	0.00055		0.026	1.01	434.7	0.00246	0.149	0.19	0.17	0.611
Average				20.035	0.000525		0.0285	1.095	433.1	0.00236	0.158	0.185	0.181	0.6385
AR314MN	6/4/96	14836	RFG	20.31	0.00045		0.026	0.75	428	0.00179	0.088	0.19	0.108	0.867
AR317MN	10/29/96	18239	RFG	19.74	0.00047		0.028	0.92	440	0.00248	0.131	0.27	0.153	0.438
AR317MN	11/18/96	18449	RFG	19.56	0.00051		0.03	1.11	443.8	0.00213	0.124	0.29	0.148	0.384
Average				19.65	0.00049		0.029	1.015	441.9	0.002305	0.1275	0.28	0.1505	0.411
AR318MN	12/11/96	18257	RFG	19.85	0.00064		0.033	1.11	437.1	0.00293	0.168	0.32	0.195	1.09
AR319MN	12/10/96	9725	RFG	19.78	0.00037		0.031	1	439	0.00244	0.162	0.26	0.187	0.799
AR319MN	12/12/96	9764	RFG	20.03	0.00052		0.024	0.82	433.7	0.00213	0.136	0.23	0.155	0.646
Average				19.905	0.000445		0.0275	0.91	436.35	0.002285	0.149	0.245	0.171	0.7225
AR320MN	11/7/96	14341	RFG	19.96	0.00046		0.024	0.88	435	0.00177	0.143	0.18	0.163	0.655
AR320MN	11/8/96	14384	RFG	20.63	0.0004		0.024	0.88	421	0.00175	0.126	0.17	0.145	0.564
Average				20.295	0.00043		0.024	0.88	428	0.00176	0.1345	0.175	0.154	0.6095
AR322MN	1/31/97	10828	RFG	20.38	0.00059		0.034	1.26	425.5	0.0024	0.182	0.19	0.209	0.644
	COUNT			16	16		16	15	16	16	16	16	16	16
	AVG			20.129	0.00059		0.0307	1.118	431.17	0.0025	0.158	0.239	0.1823	0.7117
	STD DEV			0.3596	0.00013		0.0036	0.2123	7.911	0.00049	0.0282	0.0561	0.0299	0.3313
	CV			0.0179	0.2198		0.1178	0.1899	0.0183	0.1954	0.1784	0.2348	0.1643	0.4655

Table A-7. 1993 Standard Dodge Spirit: RFG Tests at Lab 1 Round 1

Decal ID	Date	Odometer	Fuel	MPG	CH_3CHO	CH_3OH	CH_4	CO	CO_2	HCHO	NMHCE	NO_x	THC	Evap. THC
DT201GSC	5/12/94	17018	RFG	24.44	0.00017		0.013	1.15	356.2	0.00047	0.073	0.27	0.083	0.664
DT202GSC	6/27/94	20800	RFG	24.61	0.00052		0.014	1.34	353.3	0.00191	0.084	0.26	0.095	0.328
DT203GSC	6/22/94	8831	RFG	23.7	0.00046		0.011	0.94	367.7	0.00127	0.061	0.18	0.069	0.34
DT204GSC	5/13/94	5647	RFG	23.65	0.00038		0.009	0.83	368.7	0.00108	0.071	0.22	0.078	0.33
DT206GSC	7/1/94	7706	RFG	24.05	0.0004		0.011	0.8	362.5	0.00147	0.066	0.21	0.074	0.206
DT207GSC	12/16/94	35757	RFG	24.68	0.00043		0.014	1.24	352.4	0.00155	0.088	0.44	0.099	0.235
DT207GSC	12/19/94	35784	RFG	24.88	0.00046		0.013	1.27	349.6	0.00163	0.084	0.41	0.095	0.25
Average				24.78	0.000445		0.0135	1.255	351	0.00159	0.086	0.425	0.097	0.2425
DT208GSC	5/13/94	10225	RFG	24.31	0.00043		0.011	0.74	358.7	0.00148	0.071	0.28	0.08	0.305
DT209GSC	4/20/94	8362	RFG	23.91	0.00043		0.011	1.2	364	0.00137	0.077	0.22	0.086	0.259
DT210GSC	7/1/94	19117	RFG	24.83	0.00088		0.019	1.49	349.7	0.00355	0.121	0.55	0.136	0.191
DT210GSC	7/6/94	19143	RFG	24.98	0.00063		0.018	1.45	347.7	0.00242	0.118	0.54	0.132	0.24
Average				24.905	0.000755		0.0185	1.47	348.7	0.002985	0.1195	0.545	0.134	0.2155
DT211GSC	3/21/94	4339	RFG	23.57	0.00037		0.012	1.48	368.8	0.00106	0.082	0.12	0.091	0.381
DT212GSC	6/28/94	4923	RFG	24.02	0.00033		0.012	0.93	362.8	0.00117	0.068	0.15	0.078	0.265
DT213GSC	7/1/94	6547	RFG	24.09	0.00042		0.013	0.9	361.7	0.00147	0.07	0.2	0.08	0.289
DT214GSC	5/9/94	10632	RFG	24.49	0.00043		0.009	0.64	356.2	0.00139	0.059	0.31	0.066	0.301
DT214GSC	5/10/94	10659	RFG	24.26	0.00037		0.007	0.6	359.7	0.00131	0.06	0.34	0.065	0.249
Average				24.375	0.0004		0.008	0.62	357.95	0.00135	0.0595	0.325	0.066	0.275
DT215GSC	4/21/94	12278	RFG	24.37	0.00041		0.013	1.39	356.8	0.00133	0.078	0.28	0.088	0.278
DT216GSC	3/4/94	11178	RFG	23.63	0.00059		0.019	2	367	0.00166	0.091	0.27	0.106	0.264
DT216GSC	3/8/94	11204	RFG	23.77	0.00061		0.015	1.68	365.3	0.00167	0.087	0.26	0.099	0.46
Average				23.7	0.0006		0.017	1.84	366.15	0.001665	0.089	0.265	0.1025	0.362
DT217GSC	4/20/94	20267	RFG	24.37	0.00051		0.015	1.81	356.1	0.00161	0.088	0.35	0.1	0.353
DT217GSC	4/25/94	20294	RFG	24.6	0.0005		0.013	1.46	353.2	0.00167	0.08	0.28	0.09	0.327
Average				24.485	0.000505		0.014	1.635	354.65	0.00164	0.084	0.315	0.095	0.34
DT218GSC	6/22/94	12393	RFG	24.24	0.00038		0.016	1.43	358.6	0.00109	0.078	0.33	0.09	0.175
DT218GSC	6/23/94	12419	RFG	24.56	0.00048		0.013	1.22	354.3	0.00155	0.075	0.28	0.085	0.171
Average				24.4	0.00043		0.0145	1.325	356.45	0.00132	0.0765	0.305	0.0875	0.173
DT219GSC	5/12/94	11700	RFG	24.24	0.00047		0.01	0.82	359.7	0.0014	0.073	0.24	0.081	0.208
DT221GSC	4/22/94	8994	RFG	24.53	0.0004		0.013	1.12	354.8	0.00123	0.071	0.22	0.081	0.23
DT222GSC	6/23/94	20051	RFG	24.65	0.0005		0.017	1.74	352.1	0.00171	0.084	0.25	0.097	0.239
DT223GSC	5/6/94	6682	RFG	24.3	0.00031		0.012	1.08	358.2	0.00121	0.075	0.2	0.085	0.316
DT224GSC	3/1/94	11363	RFG	23.38	0.00046		0.013	1.2	372.3	0.0017	0.079	0.22	0.089	0.341
DT224GSC	3/3/94	11396	RFG	23.48	0.00062		0.012	1.14	370.7	0.00167	0.079	0.22	0.089	0.293
Average				23.43	0.00054		0.0125	1.17	371.5	0.001685	0.079	0.22	0.089	0.317
DT225GSC	5/18/94	13037	RFG	23.87	0.00034		0.017	1.42	364.2	0.00134	0.094	0.19	0.107	0.299
DT226GSC	6/27/94	5138	RFG	23.94	0.00038		0.01	0.7	364.3	0.00123	0.063	0.24	0.071	0.332
	COUNT			23	23		23	23	23	23	23	23	23	23
	AVG			24.15	0.00042		0.0125	1.149	360.53	0.00137	0.0754	0.243	0.0853	0.3034
	STD DEV			0.3776	0.00009		0.0024	0.3388	5.7824	0.0003	0.0090	0.064	0.01058	0.095
	CV			0.0156	0.2107		0.1908	0.2949	0.0160	0.2125	0.1195	0.2643	0.124	0.3131

Table A-8. 1993 FFV Dodge Spirit: M85 Tests at Lab 1 Round 1

Decal ID	Date	Odometer	Fuel	MPG	CH_3CHO	CH_3OH	CH_4	CO	CO_2	HCHO	NMHCE	NO_x	THC	Evap. THC
AR206MS	11/21/94	6735	M85	13.78	0.00017	0.1452	0.012	1.39	349	0.00928	0.09	0.1	0.095	0.53
AR209MS	11/7/94	6305	M85	13.87	0.00017	0.1227	0.015	1.78	346.2	0.00642	0.087	0.04	0.095	0.54
AR212MS	11/9/94	7648	M85	13.83	0.00016	0.1505	0.016	1.75	347.2	0.01133	0.097	0.18	0.104	0.599
DT203MS	3/22/94	4620	M85	12.86	0.00037	0.2283	0.014	2.09	368.2	0.01157	0.142	0.04	0.147	0.576
DT208MS	5/5/94	11028	M85	13.67	0.00037	0.23	0.019	1.97	350.9	0.01306	0.154	0.28	0.163	0.527
DT211MS	5/24/94	4826	M85	13.59	0.00029	0.1273	0.014	1.08	349.9	0.01393	0.096	0.28	0.1	0.615
DT212MS	3/25/94	4339	M85	13.86	0.00028	0.1595	0.011	1.12	343	0.01129	0.106	0.11	0.109	0.348
DT219MS	6/13/94	17116	M85	13.61	0.00032	0.1465	0.017	1.16	349.2	0.01367	0.102	0.26	0.108	0.755
DT221MS	5/3/94	11588	M85	13.84	0.0002	0.1189	0.012	1.05	343.5	0.01254	0.095	0.21	0.098	0.486
DT223MS	3/3/94	9666	M85	13.83	0.00039	0.1429	0.012	1.2	343.6	0.01327	0.116	0.07	0.119	1.827
DT223MS	3/9/94	9779	M85	13.77	0.00054	0.1568	0.012	1.18	345.1	0.01394	0.099	0.06	0.102	1.549
Average				13.8	0.000465	0.14985	0.012	1.19	344.35	0.013605	0.1075	0.065	0.1105	1.688
DT225MS	4/4/94	8871	M85	13.53	0.00041	0.2477	0.025	4.73	350	0.01256	0.162	0.63	0.176	0.693
DT225MS	4/6/94	8897	M85	13.37	0.00035	0.166	0.015	1.16	355.4	0.01291	0.096	0.23	0.101	0.615
Average				13.45	0.00038	0.20685	0.02	2.945	352.7	0.012735	0.129	0.43	0.1385	0.654
DT226MSC	6/2/94	15299	M85	13.68	0.00039	0.1338	0.019	1.19	347.3	0.01874	0.101	0.43	0.106	0.865
DT226MSC	6/3/94	15325	M85	13.59	0.00042	0.1568	0.02	1.25	349.6	0.01765	0.105	0.39	0.113	0.88
Average				13.635	0.000405	0.1453	0.0195	1.22	348.45	0.018195	0.103	0.41	0.1095	0.8725
DT229MS	3/28/94	9762	M85	13.53	0.00025	0.1273	0.012	1.08	351.4	0.01174	0.088	0.21	0.092	0.53
DT230MS	5/24/94	5973	M85	13.45	0.00026	0.1279	0.014	1.3	353.2	0.00971	0.104	0.11	0.11	0.459
DT233MS	3/3/94	4175	M85	13.32	0.00035	0.1689	0.011	1.06	356.9	0.00977	0.113	0.06	0.117	2.582
DT233MS	3/7/94	4249	M85	13.51	0.00039	0.1579	0.013	1.45	351.4	0.01253	0.121	0.04	0.125	0.434
Average				13.415	0.00037	0.1634	0.012	1.255	354.15	0.01115	0.117	0.05	0.121	1.508
DT238MS	4/28/94	12270	M85	13.45	0.00031	0.1893	0.022	1.77	352.3	0.01381	0.135	0.37	0.145	0.664
DT238MS	4/29/94	12296	M85	13.55	0.00049	0.179	0.022	1.87	349.6	0.01962	0.137	0.35	0.145	0.692
Average				13.5	0.0004	0.18415	0.022	1.82	350.95	0.016715	0.136	0.36	0.145	0.678
DT241MS	4/5/94	4108	M85	13.45	0.00029	0.1518	0.014	1.07	353.6	0.00996	0.093	0.35	0.098	0.348
DT241MS	4/7/94	4134	M85	13.28	0.00034	0.1819	0.014	1.12	357.9	0.01261	0.1	0.34	0.105	0.302
Average				13.365	0.000315	0.16685	0.014	1.095	355.75	0.011285	0.0965	0.345	0.1015	0.325
DT245MS	5/19/94	3704	M85	13.25	0.00017	0.2325	0.015	1	358.9	0.01189	0.132	0.3	0.104	0.918
DT245MS	5/20/94	3730	M85	13.36	0.00026	0.1184	0.018	1	356.2	0.0133	0.088	0.32	0.094	0.821
Average				13.305	0.000215	0.17545	0.0165	1	357.55	0.012595	0.11	0.31	0.099	0.8695
DT250MS	6/2/94	9419	M85	13.62	0.00031	0.1418	0.017	1.46	348.4	0.01163	0.103	0.29	0.108	0.474
DT250MS	6/3/94	9445	M85	13.58	0.00036	0.136	0.016	1.02	350.1	0.01717	0.094	0.29	0.097	0.407
Average				13.6	0.000335	0.1389	0.0165	1.24	349.25	0.0144	0.0985	0.29	0.1025	0.4405
DT251MSC	6/2/94	18203	M85	13.45	0.00037	0.1254	0.014	1.32	353.2	0.01652	0.102	0.1	0.104	0.859
DT252MS	4/4/94	9204	M85	13.33	0.00043	0.2093	0.018	1.22	356.4	0.01522	0.115	0.28	0.108	1.007
	COUNT			21	21	21	20	21	19	21	21	21	21	21
	AVG			13.559	0.00031	0.1595	0.0149	1.432	350.28	0.0127	0.108	0.212	0.1124	0.7079
	STD DEV			0.2423	0.00009	0.0345	0.0028	0.4742	4.265	0.0027	0.0181	0.1249	0.0194	0.346
	CV			0.0179	0.293	0.2161	0.1855	0.3311	0.0122	0.211	0.167	0.588	0.173	0.4886

Table A-9. 1993 FFV Dodge Spirit: RFG Tests at Lab 1 Round 1

Decal ID	Date	Odometer	Fuel	MPG	CH_3CHO	CH_3OH	CH_4	CO	CO_2	HCHO	NMHCE	NO_x	THC	Evap. THC
AR206MS	11/22/94	6769	RFG	22.87	0.00039		0.017	1.1	380.7	0.00123	0.112	0.2	0.126	0.583
AR209MS	11/8/94	6338	RFG	22.97	0.00035		0.023	1.3	378.7	0.00094	0.11	0.06	0.129	1.472
AR212MS	11/7/94	7617	RFG	22.88	0.00042		0.024	1.61	379.6	0.00124	0.111	0.21	0.131	0.17
DT203MS	3/25/94	4695	RFG	22.65	0.0005		0.027	1.66	383.3	0.00112	0.141	0.08	0.163	0.602
DT208MS	5/6/94	11062	RFG	21.4	0.00052		0.025	1.61	406.1	0.00142	0.12	0.13	0.139	0.741
DT211MS	5/18/94	4733	RFG	22.81	0.00056		0.024	1.07	381.6	0.00148	0.112	0.27	0.131	0.438
DT212MS	3/24/94	4305	RFG	23.44	0.00049		0.022	1.36	370.9	0.00131	0.109	0.08	0.126	0.703
DT219MS	6/1/94	16919	RFG	22.95	0.00054		0.032	1.69	378.2	0.00155	0.148	0.1	0.172	0.656
DT221MS	4/28/94	11500	RFG	23.71	0.00046		0.022	1.1	367.1	0.00141	0.114	0.1	0.132	0.202
DT223MS	3/2/94	9633	RFG	23.36	0.00077		0.025	1.42	371.9	0.0027	0.164	0.08	0.184	1.28
DT223MS	3/8/94	9745	RFG	23.38	0.00058		0.024	1.37	371.8	0.00155	0.154	0.07	0.173	3.355
Average				23.37	0.000675		0.0245	1.395	371.85	0.002125	0.159	0.075	0.1785	2.3175
DT225MS	3/29/94	8804	RFG	22.71	0.00048		0.023	1.19	383.2	0.00129	0.108	0.16	0.126	0.655
DT226MSC	6/1/94	15257	RFG	23.03	0.0007		0.031	1.39	377.3	0.00263	0.163	0.23	0.187	0.832
DT229MS	4/8/94	9801	RFG	22.56	0.00048		0.024	1.02	386	0.00131	0.1	0.4	0.119	0.516
DT229MS	4/11/94	9827	RFG	22.68	0.00047		0.022	1.08	384	0.00123	0.109	0.32	0.126	0.417
Average				22.62	0.000475		0.023	1.05	385	0.00127	0.1045	0.36	0.1225	0.4665
DT230MS	5/26/94	6032	RFG	23.15	0.00048		0.038	1.69	374.8	0.00131	0.17	0.09	0.2	0.461
DT233MS	3/4/94	4208	RFG	22.61	0.00026		0.036	1.69	383.9	0.00055	0.178	0.09	0.206	1.949
DT233MS	3/9/94	4317	RFG	22.63	0.00051		0.035	1.76	383.4	0.00132	0.167	0.07	0.194	0.546
Average				22.62	0.000385		0.0355	1.725	383.65	0.000935	0.1725	0.08	0.2	1.2475
DT238MS	4/27/94	12237	RFG	22.67	0.00048		0.042	2.07	382.3	0.00175	0.156	0.25	0.189	0.534
DT241MS	3/31/94	4075	RFG	22.67	0.00044		0.02	1.24	383.9	0.00117	0.104	0.11	0.12	0.354
DT245MS	5/26/94	3809	RFG	22.6	0.00044		0.023	1.02	385.3	0.00128	0.108	0.19	0.126	0.943
DT250MS	6/7/94	9505	RFG	23.16	0.00054		0.022	0.77	376.4	0.00186	0.109	0.18	0.125	0.604
DT251MSC	6/6/94	18237	RFG	22.6	0.00062		0.039	2.84	382.3	0.00193	0.175	0.11	0.205	0.939
DT251MSC	6/22/94	18312	RFG	22.37	0.00063		0.039	2.75	386.4	0.00207	0.19	0.1	0.221	0.58
Average				22.485	0.000625		0.039	2.795	384.35	0.002	0.1825	0.105	0.213	0.7595
DT252MS	4/7/94	9245	RFG	22.48	0.0006		0.029	1.59	386.5	0.00158	0.121	0.12	0.143	0.462
	COUNT			21	21		20	21	19	21	21	21	21	21
	AVG			22.82	0.0005		0.0262	1.45	379.54	0.0015	0.130	0.151	0.151	0.7239
	STD DEV			0.4611	0.00009		0.006	0.438	5.403	0.0004	0.0267	0.0792	0.0312	0.476
	CV			0.0202	0.1826		0.229	0.3026	0.0142	0.279	0.2049	0.523	0.2064	0.6574

Table A-10. 1993 Standard Dodge Spirit: RFG Tests at Lab 3 Round 1

Decal ID	Date	Odometer	Fuel	MPG	CH_3CHO	CH_3OH	CH_4	CO	CO_2	HCHO	NMHCE	NO_x	THC	Evap. THC
DV201GSC	8/30/94	22240	RFG	24.86	0.0005		0.0136	1.74	345.9	0.0012	0.0929	0.404	0.1029	0.1691
DV201GSC	8/31/94	22266	RFG	24.75	0.0006		0.0122	1.576	347.73	0.0013	0.0899	0.449	0.1011	*
Average				24.80	0.00055		0.0129	1.66015	346.81	0.00125	0.0891	0.42625	0.102	0.1691
DV203GSC	4/12/95	24331	RFG	25.63	0.0004		0.0124	1.6073	335.69	0.0011	0.065	0.3923	0.0774	0.1442
DV204GSC	3/24/95	15918	RFG	25.39	0.0002		0.0131	1.5448	338.92	0.0007	0.0652	0.4245	0.0783	0.3127
DV205GSC	4/12/95	21718	RFG	25.78	0.0003		0.0119	1.7261	333.45	0.0009	0.0718	0.3389	0.0837	0.2399
DV208GSC	3/7/95	19846	RFG	25.25	0.0002		0.0134	1.8154	340.39	0.0007	0.0659	0.4489	0.0793	0.2992
DV209GSC	5/25/94	11052	RFG	25.22	0.0002		0.0095	1.2271	341.68	0.0009	0.0736	0.3688	0.0831	0.3456
DV211GSC	3/22/94	9757	RFG	25.14	0.0003		0.0089	1.056	343.1	0.0007	0.0658	0.239	0.072	0.4202
DV211GSC	3/23/94	9783	RFG	25.06	0.0004		0.0081	0.995	344.4	0.0007	0.0634	0.187	0.069	0.3965
Average				25.09	0.00035		0.0085	1.0255	343.75	0.0007	0.06225	0.21315	0.07075	0.40835
DV212GSC	7/29/94	5743	RFG	24.46	0.0001		0.0104	1.255	352.4	0.0009	0.0729	0.361	0.0805	0.2157
DV212GSC	8/1/94	5771	RFG	23.86	0.0002		0.0103	1.438	361	0.001	0.0761	0.362	0.0836	*
Average				24.16	0.00015		0.01035	1.3464	356.72	0.00095	0.0717	0.3616	0.08205	0.2157
DV213GSC	3/11/94	10425	RFG	24.9	0.0017		0.0119	1.543	345.5	0.0016	0.0734	0.377	0.0819	0.2024
DV213GSC	3/15/94	10458	RFG	24.7	0.0011		0.0078	0.981	349.1	0.0011	0.0694	0.301	0.0737	0.2438
Average				24.81	0.0014		0.00985	1.26215	347.34	0.00135	0.06795	0.33905	0.0778	0.2231
DV214GSC	9/20/94	10301	RFG	25.15	0.0006		0.0094	1.19	342.7	0.001	0.0748	0.339	0.081	0.2486
DV214GSC	9/21/94	10328	RFG	24.78	0.0006		0.0083	1.55	347.4	0.001	0.075	0.281	0.0803	*
Average				24.96	0.0006		0.00885	1.37175	345.05	0.001	0.0718	0.3102	0.08065	0.2486
DV215GSC	3/14/95	20166	RFG	26.00	0.0001		0.0145	1.7798	330.48	0.0006	0.073	0.3607	0.0875	0.3508
DV216GSC	3/23/95	13427	RFG	25.44	0.0002		0.0152	2.1305	337.26	0.0009	0.0746	0.4405	0.0898	0.3466
DV217GSC	7/6/94	14589	RFG	25.2	0.0004		0.0104	1.228	341.99	0.0011	0.0711	0.401	0.0786	0.1289
DV217GSC	7/7/94	14614	RFG	24.97	0.0004		0.0093	1.299	345.1	0.0013	0.0675	0.446	0.0737	*
Average				25.09	0.0004		0.00985	1.2636	343.55	0.0012	0.0663	0.4233	0.07615	0.1289
DV219GSC	3/9/95	28005	RFG	24.97	0.0001		0.0126	1.8194	344.33	0.0006	0.0584	0.5176	0.071	0.4365
DV220GSC	3/9/95	15570	RFG	25.66	0.0001		0.0103	1.3683	335.68	0.0006	0.0649	0.3252	0.0752	0.2786
DV221GSC	4/4/95	19640	RFG	26.12	0.0001		0.0092	1.1467	330.01	0.001	0.0643	0.5971	0.0735	0.4519
DV222GSC	3/28/95	16309	RFG	25.81	0.0002		0.0117	1.4105	333.59	0.0006	0.0577	0.3634	0.0694	0.231
DV223GSC	6/23/94	10942	RFG	24.96	0.0002		0.0167	2.777	342.9	0.0008	0.0848	0.403	0.0988	0.2567
DV223GSC	6/24/94	10974	RFG	25.11	0.0003		0.0135	2.167	341.8	0.001	0.0769	0.366	0.0865	*
Average				25.03	0.00025		0.0151	2.4721	342.36	0.0009	0.07755	0.3843	0.09265	0.2567
DV224GSC	5/16/94	22226	RFG	25.4	0.0003		0.0065	1.482	338.6	0.0009	0.0774	0.3797	0.0813	0.254
DV224GSC	5/18/94	22252	RFG	25.7	0.0003		0.0086	1.133	335.5	0.0007	0.0782	0.327	0.084	*
Average				25.56	0.0003		0.00755	1.3078	337.05	0.0008	0.0751	0.35345	0.08265	0.254
DV226GSC	2/15/95	9051	RFG	25.17	0.0001		0.0113	1.2387	342.39	0.0005	0.0698	0.5617	0.0738	6.8507
	COUNT			20	19		20	20	20	20	20	20	20	20
	AVG			25.299	0.00025		0.0114	1.526	340.32	0.00086	0.069	0.398	0.080	0.6096
	STD DEV			0.4699	0.0001		0.0022	0.356	6.456	0.00024	0.0072	0.088	0.0081	1.4717
	CV			0.0186	0.595		0.1961	0.233	0.019	0.279	0.104	0.222	0.1006	2.414

Table A-11. 1993 FFV Dodge Spirit: M85 Tests at Lab 3 Round 1

Decal ID	Date	Odometer	Fuel	MPG	CH_3CHO	CH_3OH	CH_4	CO	CO_2	HCHO	NMHCE	NO_x	THC	Evap. THC
DV205MS	6/1/94	9621	M85	12.87	0.0002	0.1313	0.0188	1.247	329.43	0.0114	0.0862	0.452	0.0414	0.2466
DV205MS	6/2/94	9647	M85	12.69	0.0002	0.1277	0.0196	1.225	334.2	0.0108	0.1202	0.46	0.0777	*
Average				12.78	0.0002	0.1295	0.0192	1.236	331.82	0.0111	0.1032	0.456	0.05955	0.2466
DV206MS	6/9/94	9015	M85	12.47	0.0002	0.101	0.0142	1.397	339.82	0.0095	0.1011	0.236	0.066	0.5182
DV206MS	8/16/94	9921	M85	12.86	0.0003	0.1164	0.0164	1.664	328.97	0.0068	0.1116	0.245	0.073	0.3431
Average				12.67	0.00025	0.1087	0.0153	1.530	334.39	0.00815	0.10635	0.24035	0.0694	0.43065
DV207MS	5/24/94	4138	M85	12.45	0.0002	0.1286	0.0114	1.546	340.19	0.0066	0.1094	0.0501	0.0605	0.1965
DV208MS	4/6/94	9715	M85	12.44	0.0002	0.1205	0.0133	1.327	340.89	0.0066	0.1123	0.15	0.069	0.2613
DV208MS	4/19/94	9859	M85	12.5	0.0001	0.1544	0.0128	1.429	339.03	0.0067	0.1033	0.102	0.045	0.3252
Average				12.47	0.00015	0.13745	0.01305	1.378	339.96	0.00665	0.1078	0.12605	0.05695	0.29325
DV209MS	4/12/94	6449	M85	12.35	0.0004	0.095	0.0093	1.494	343.1	0.0086	0.1004	0.132	0.0633	0.2879
DV209MS	4/28/94	6641	M85	12.64	0.0002	0.113	0.0146	1.709	334.8	0.0061	0.0992	0.106	0.061	0.5483
Average				12.49	0.0003	0.10415	0.01195	1.601	338.98	0.00735	0.0998	0.11895	0.062	0.4181
DV211MS	9/13/94	21298	M85	12.94	0.0002	0.1467	0.0156	1.924	326.66	0.0106	0.1209	0.1514	0.0665	0.7572
DV212MS	8/2/94	10896	M85	12.73	0.0003	0.1558	0.0186	1.66	332.6	0.0112	0.097	0.5617	0.0418	0.1646
DV212MS	8/3/94	10922	M85	12.5	0.0003	0.1269	0.0191	1.454	338.96	0.0114	0.1038	0.5164	0.0614	*
Average				12.61	0.0003	0.14135	0.01885	1.555	335.77	0.0113	0.10045	0.53905	0.0516	0.1646
DV220MS	12/6/94	17369	M85	12.94	0.0001	0.1204	0.0126	1.304	327.58	0.0102	0.1142	0.2737	0.0685	0.2527
DV226MS	8/11/94	10067	M85	12.84	0.0003	0.1635	0.0145	2.20	328.74	0.0065	0.0873	0.1067	0.0264	0.5088
DV227MS	4/29/94	5295	M85	12.48	0.0003	0.074	0.01	1.079	340.15	0.0087	0.0796	0.2532	0.0524	0.2224
DV229MS	7/21/94	23103	M85	12.72	0.0001	0.164	0.0176	1.969	332.16	0.0104	0.138	0.378	0.078	0.3542
DV229MS	7/22/94	23129	M85	12.79	0.0001	0.2	0.0177	1.824	330.62	0.0122	0.14	0.369	0.064	*
Average				12.76	0.0001	0.18205	0.01765	1.896	331.39	0.0113	0.13935	0.37355	0.0712	0.3542
DV230MS	12/14/94	19021	M85	12.93	0.0001	0.1646	0.0157	2.240	326.25	0.0084	0.1363	0.2563	0.0755	0.3952
DV231MS	7/14/94	22041	M85	12.72	0.0001	0.1786	0.0227	2.674	331.13	0.0125	0.124	0.1896	0.0618	0.2852
DV233MS	6/21/94	20380	M85	12.67	0.0002	0.1537	0.0183	1.642	334.20	0.0133	0.0886	0.2928	0.0324	0.2673
DV242MS	6/14/94	4080	M85	12.71	0.0002	0.1332	0.0125	1.095	333.79	0.0096	0.0926	0.1856	0.0416	0.4552
DV244MS	9/9/94	10055	M85	12.89	0.0003	0.1424	0.0109	1.526	328.57	0.0072	0.1438	0.0955	0.0881	0.3572
DV246MS	6/28/94	8838	M85	13.16	0.0001	0.1301	0.0158	1.235	322.18	0.0111	0.1133	0.2448	0.066	0.243
DV248MS	7/22/94	9292	M85	12.67	0.0003	0.1468	0.02	2.13	333.35	0.0075	0.1105	0.1341	0.0619	0.4245
DV249MS	2/2/95	13241	M85	12.88	0.0002	0.1314	0.0172	2.020	327.89	0.0073	0.1096	0.2481	0.0651	0.7784
DV251MS	11/2/94	24502	M85	13.03	0.0001	0.1741	0.0103	1.961	324.13	0.011	0.1521	0.184	0.0804	0.2466
DV257MS	10/25/94	26058	M85	12.9	0.0001	0.137	0.0079	1.431	328.34	0.0076	0.1156	0.1926	0.0595	0.2128
DV258MS	12/1/94	24187	M85	13.13	0.0002	0.125	0.0132	1.702	322.18	0.0085	0.1208	0.2104	0.0749	0.6462
	COUNT			22	22	22	20	21	22	21	21	20	21	22
	AVG			12.78	0.00019	0.139	0.014	1.630	331.26	0.009	0.1123	0.207	0.061	0.3708
	STD DEV			0.2071	8E-05	0.0254	0.0039	0.355	5.5767	0.0021	0.019	0.097	0.015	0.1735
	CV			0.0162	0.4095	0.1829	0.267	0.217	0.0168	0.23	0.1695	0.470	0.241	0.468

Table A-12. 1993 FFV Dodge Spirit: RFG Tests at Lab 3 Round 1

Decal ID	Date	Odometer	Fuel	MPG	CH_3CHO	CH_3OH	CH_4	CO	CO_2	HCHO	NMHCE	NO_x	THC	Evap. THC
DV205MS	5/27/94	9587	RFG	24.01	0.0004		0.0252	1.5243	358.3	0.0012	0.1479	0.1996	0.1701	0.4855
DV206MS	6/7/94	8962	RFG	23.6	0.0003		0.0253	0.802	365.86	0.0009	0.0924	0.4669	0.1154	0.6009
DV206MS	6/8/94	8989	RFG	23.55	0.0002		0.027	1.202	366.05	0.0008	0.1054	0.4308	0.13	*
Average				23.58	0.00025		0.02615	1.002	365.96	0.00085	0.0989	0.4489	0.1227	0.6009
DV207MS	5/10/94	4104	RFG	23.2	0.0003		0.0332	2.1742	369.72	0.0008	0.2267	0.1009	0.257	0.3023
DV208MS	4/5/94	9674	RFG	27.98	0.0004		0.0152	1.181	307.74	0.001	0.1015	0.0655	0.1143	0.3178
DV208MS	4/13/94	9782	RFG	23.62	0.0008		0.0216	1.492	364.51	0.0003	0.0958	0.0937	0.1151	0.5034
Average				25.80	0.0006		0.0184	1.3363	336.13	0.00065	0.0986	0.0796	0.1147	0.4106
DV209MS	4/20/94	6515	RFG	23.39	0.003		0.0544	1.938	366.1	0.0008	0.508	0.0955	0.56	0.2308
DV209MS	4/26/94	6589	RFG	23.49	0.002		0.207	1.328	366.4	0.0007	0.225	0.0941	0.244	0.2088
DV209MS	4/27/94	6615	RFG	23.56	0.002		0.0192	1.438	365.5	0.0008	0.127	0.0907	0.144	*
Average				23.48	0.00023		0.031433	1.5681	365.97	0.00077	0.2868	0.09343	0.3158	0.2198
DV211MS	9/16/94	21366	RFG	24.01	0.0006		0.0239	1.8299	357.88	0.0013	0.1604	0.1209	0.1809	0.6268
DV212MS	8/4/94	10948	RFG	23.19	0.0005		0.0341	1.8857	370.47	0.0015	0.1529	0.5464	0.1835	0.2136
DV220MS	12/15/94	17436	RFG	24.67	0.0002		0.0206	1.2467	349.21	0.0011	0.1302	0.2235	0.1481	0.3683
DV226MS	8/10/94	10033	RFG	24.35	0.0004		0.0294	2.1722	352.20	0.0007	0.1647	0.1036	0.1912	0.7326
DV227MS	5/4/94	5369	RFG	23.53	0.0004		0.031	1.7451	365.06	0.0007	0.2618	0.0993	0.2903	0.2462
DV229MS	7/13/94	23000	RFG	24.52	0.0004		0.0327	1.649	350.5	0.0022	0.1728	0.329	0.2014	0.4395
DV229MS	7/14/94	23026	RFG	24.07	0.0004		0.0329	2.018	356.5	0.0021	0.1715	0.295	0.2004	*
Average				24.30	0.0004		0.0328	1.8333	353.48	0.00215	0.1721	0.312	0.2009	0.4395
DV230MS	12/20/94	19054	RFG	24.19	0.0002		0.0263	1.7571	355.31	0.001	0.144	0.2268	0.1673	0.4594
DV231MS	7/12/94	21989	RFG	24.07	0.0003		0.049	3.482	354.1	0.0019	0.1906	0.218	0.236	0.2593
DV231MS	7/13/94	22015	RFG	24.07	0.0003		0.05	3.614	353.9	0.0018	0.1983	0.203	0.244	*
Average				24.07	0.0003		0.04955	3.5479	354.0	0.0019	0.1944	0.2107	0.2400	0.2593
DV233MS	6/17/94	20346	RFG	23.20	0.0004		0.0335	2.2903	369.67	0.0016	0.1456	0.2055	0.1756	0.3583
DV242MS	6/15/94	4114	RFG	23.39	0.0002		0.0211	1.1115	368.65	0.001	0.1061	0.2229	0.1245	1.2739
DV244MS	9/8/94	10021	RFG	23.82	0.0004		0.034	2.5522	359.60	0.001	0.1509	0.1111	0.1817	0.4811
DV246MS	7/1/94	8923	RFG	24.48	0.0008		0.1119	3.1576	346.19	0.0017	0.9239	0.1716	1.033	0.3184
DV246MS	7/6/94	8948	RFG	23.86	0.0004		0.0236	1.4322	360.8	0.0012	0.1123	0.1901	0.133	*
Average				24.17	0.0006		0.6775	2.2949	353.51	0.00145	0.5181	0.1808	0.5831	0.3184
DV248MS	7/27/94	9360	RFG	23.9	0.0003		0.0409	2.515	358.1	0.0012	0.1746	0.1539	0.2126	0.5297
DV248MS	7/28/94	9386	RFG	23.8	0.0002		0.0403	2.472	359.4	0.0013	0.1795	0.1511	0.2169	*
Average				23.87	0.00025		0.0406	2.49355	358.74	0.00125	0.1770	0.1525	0.21475	0.5297
DV249MS	2/1/95	13207	RFG	24.47	0.0003		0.0285	1.7741	351.14	0.001	0.1245	0.1856	0.1503	0.6819
DV251MS	11/3/94	24535	RFG	24.57	0.0003		0.0187	2.1405	349.04	0.0011	0.1854	0.181	0.2013	0.531
DV257MS	10/26/94	26092	RFG	24.76	0.0003		0.0135	1.705	347.05	0.0014	0.1423	0.1386	0.1529	0.3034
DV258MS	11/17/94	24094	RFG	24.85	0.0002		0.0216	1.4529	346.31	0.0011	0.141	0.1732	0.1601	0.7081
	COUNT			22	22		20	21	22	21	21	20	21	22
	AVG			24.068	0.00035		0.0282	1.804	357.15	0.0011	0.1625	0.166	0.1878	0.4795
	STD DEV			0.6459	0.00013		0.0085	0.4377	9.1124	0.00039	0.0485	0.060	0.0524	0.238
	CV			0.0268	0.3730		0.2996	0.2426	0.0255	0.3398	0.2984	0.361	0.279	0.497

Table A-13. 1993 Standard Dodge Spirit: RFG Tests at Lab 1 Round 2

Decal ID	Date	Odometer	Fuel	MPG	CH_3CHO	CH_3OH	CH_4	CO	CO_2	HCHO	NMHCE	NO_x	THC	Evap. THC
DT201GSC	9/1/95	49527	RFG	23.07	0.00029		0.014	1.76	374.6	0.00133	0.071	0.38	0.083	0.227
DT202GSC	8/23/95	47024	RFG	23.59	0.00039		0.019	2.19	365.4	0.00195	0.107	0.39	0.122	0.145
DT203GSC	8/24/95	24411	RFG	23.66	0.00032		0.014	1.48	365.6	0.00145	0.066	0.29	0.077	0.233
DT204GSC	3/21/95	16373	RFG	24.18	0.00031		0.011	1.07	360.1	0.00102	0.069	0.28	0.078	0.27
DT206GSC	3/21/95	15745	RFG	24.26	0.00033		0.013	1.17	358.8	0.00108	0.071	0.23	0.081	0.227
DT207GSC	1/31/96	61638	RFG	20.81	0.01024		0.34	75.36	293.8	0.0102	1.767	0.39	2.06	0.258
DT207GSC	2/1/96	61638	RFG	21.27	0.0084		0.296	67.14	298.2	0.00888	1.566	0.35	1.82	0.183
Average				21.04	0.00932		0.318	71.25	296	0.00954	1.6665	0.37	1.94	0.157
DT208GSC	12/22/94	21005	RFG	24.32	0.00041		0.015	1.18	357.7	0.00158	0.078	0.35	0.09	0.465
DT208GSC	12/23/94	21031	RFG	23.45	0.00036		0.012	1.25	371.1	0.00132	0.07	0.31	0.081	0.31
Average				23.885	0.000385		0.0135	1.215	364.4	0.00145	0.074	0.33	0.0855	0.3875
DT209GSC	8/15/95	25494	RFG	23.79	0.00025		0.017	1.67	363.3	0.00135	0.091	0.32	0.104	0.147
DT210GSC	4/5/95	32837	RFG	22.73	0.00069		0.026	2.43	380.7	0.00294	0.142	0.71	0.163	0.297
DT211GSC	5/19/95	14354	RFG	24.54	0.00026		0.009	0.89	355.2	0.00115	0.06	0.2	0.067	0.211
DT212GSC	5/25/95	18101	RFG	24.31	0.00024		0.013	1.55	355.7	0.00101	0.07	0.22	0.08	0.226
DT213GSC	4/5/95	10036	RFG	23.66	0.00032		0.014	1.26	367.8	0.001	0.076	0.21	0.087	0.218
DT214GSC	8/10/95	32278	RFG	23.64	0.00033		0.013	1.38	366.1	0.00186	0.072	0.42	0.082	0.184
DT215GSC	3/29/95	28083	RFG	23.76	0.00037		0.015	1.47	365.9	0.00138	0.07	0.36	0.082	0.335
DT216GSC	4/6/95	27787	RFG	24.53	0.00044		0.021	2	353.3	0.00164	0.1	0.3	0.116	0.291
DT217GSC	4/12/95	44023	RFG	23.9	0.00047		0.018	2.07	362.6	0.00178	0.095	0.39	0.109	0.257
DT218GSC	12/22/94	20036	RFG	24.32	0.00032		0.015	1.29	357.6	0.00132	0.074	0.035	0.086	0.249
DT218GSC	12/23/94	20062	RFG	24.58	0.00034		0.013	1.22	354	0.00145	0.072	0.035	0.082	0.187
Average				24.45	0.00033		0.014	1.255	355.8	0.001385	0.073	0.35	0.084	0.218
DT219GSC	8/23/95	32426	RFG	23.04	0.00025		0.014	1.05	376.2	0.00126	0.085	0.36	0.096	0.286
DT221GSC	8/16/95	23507	RFG	22.02	0.00032		0.022	2.53	391.4	0.00147	0.083	0.3	0.1	0.154
DT222GSC	4/12/95	34350	RFG	23.74	0.00042		0.022	2.58	364.3	0.00127	0.097	0.33	0.114	0.288
DT223GSC	12/22/94	10667	RFG	23.85	0.00036		0.015	1.18	365	0.00129	0.075	0.22	0.087	0.25
DT224GSC	3/21/95	39548	RFG	23.91	0.00042		0.015	1.86	362.9	0.00146	0.083	0.33	0.096	0.28
DT225GSC	5/15/95	25452	RFG	24.45	0.00031		0.019	1.54	355.3	0.00129	0.086	0.22	0.101	0.219
DT226GSC	3/21/95	13310	RFG	24.14	0.00035		0.016	1.61	359.8	0.00117	0.083	0.25	0.095	0.327
	COUNT			22	22		22	22	21	22	22	22	22	22
	AVG			23.83	0.00034		0.0155	1.581	362.77	0.0014	0.0799	0.3036	0.0921	0.2446
	STD DEV			0.5796	6.33E-05		0.0034	0.466	6.0199	0.00026	0.012	0.0672	0.0143	0.0613
	CV			0.0243	0.1864		0.2201	0.2948	0.0166	0.1922	0.1526	0.2212	0.1558	0.2505

Table A-14. 1993 FFV Dodge Spirit: M85 Tests at Lab 1 Round 2

Decal ID	Date	Odometer	Fuel	MPG	CH_3CHO	CH_3OH	CH_4	CO	CO_2	HCHO	NMHCE	NO_x	THC	Evap. THC
AR206MS	11/9/95	10516	M85	13.48	0.00011	0.1379	0.015	1.53	356.6	0.01001	0.095	0.28	0.102	0.399
AR209MS	11/14/95	13755	M85	13.76	0.00016	0.1355	0.015	1.34	349.5	0.01026	0.092	0.12	0.1	0.957
AR212MS	11/10/95	12365	M85	13.76	0.00014	0.1201	0.012	1.28	349.8	0.01182	0.085	0.39	0.089	0.419
DT203MS	5/4/95	9523	M85	13.73	0.00018	0.1166	0.016	2.01	349.3	0.00826	0.097	0.06	0.106	1.177
DT208MS	3/24/95	23723	M85	14.05	0.00019	0.1694	0.019	1.74	341.8	0.0122	0.122	0.26	0.131	1.578
DT211MS	3/17/95	8257	M85	14.01	0.00016	0.1539	0.015	1.14	343.6	0.01133	0.092	0.21	0.099	0.823
DT212MS	3/23/95	8916	M85	13.82	0.00016	0.1383	0.013	1.17	348.3	0.00989	0.091	0.18	0.097	0.711
DT219MS	6/22/95	29679	M85	13.67	0.00023	0.1663	0.016	1.77	351.2	0.01729	0.113	0.13	0.118	0.784
DT221MS	3/16/95	22320	M85	14.46	0.0002	0.1794	0.015	1.45	332.4	0.01269	0.104	0.13	0.11	0.444
DT223MS	3/16/95	26844	M85	14.06	0.00022	0.1544	0.018	2.09	340.8	0.01355	0.117	0.08	0.125	0.877
DT225MS	3/10/95	18838	M85	14.16	0.00027	0.167	0.015	1.64	339.1	0.01241	0.106	0.12	0.112	0.731
DT226MSC	3/20/95	26934	M85	13.7	0.00024	0.1833	0.019	1.6	350.7	0.0154	0.115	0.35	0.123	1.019
DT229MS	6/20/95	17743	M85	13.81	0.00022	0.1365	0.015	1.27	348.4	0.01385	0.097	0.2	0.103	0.451
DT230MS	4/3/95	8633	M85	13.65	0.00018	0.1398	0.013	1.33	352.6	0.00888	0.086	0.07	0.092	0.508
DT233MS	5/8/95	9446	M85	13.71	0.00016	0.1716	0.017	2.08	349.7	0.01085	0.116	0.04	0.124	0.809
DT238MS	3/14/95	27009	M85	13.6	0.00028	0.2181	0.027	2.25	352.2	0.01674	0.142	0.33	0.155	1.24
DT241MS	5/19/95	9014	M85	13.53	0.00018	0.0797	0.016	1.13	356.1	0.00791	0.076	0.17	0.085	0.484
DT245MS	6/22/95	7683	M85	13.37	0.00015	0.1594	0.014	1.02	360.5	0.01325	0.096	0.24	0.101	0.774
DT250MS	3/10/95	21533	M85	13.92	0.00025	0.1639	0.018	2.3	344.1	0.01318	0.111	0.18	0.119	0.658
DT251MSC	6/20/95	27849	M85	13.5	0.00019	0.1804	0.019	1.95	355.4	0.01598	0.12	0.11	0.127	0.805
DT252MS	3/16/95	17953	M85	14.01	0.00024	0.1711	0.017	1.81	342.6	0.01422	0.109	0.18	0.115	0.731
	COUNT			21	21	21	20	21	19	21	21	21	21	21
	AVG			13.798	0.00019	0.154	0.0159	1.6143	348.61	0.0124	0.1039	0.182	0.111	0.7799
	STD DEV			0.2602	4.49E-05	0.0292	0.0020	0.3934	6.858	0.0027	0.0155	0.097	0.0166	0.2991
	CV			0.0189	0.2294	0.1889	0.1299	0.2437	0.0197	0.2159	0.1489	0.534	0.149	0.3835

Table A-15. 1993 FFV Dodge Spirit: RFG Tests at Lab 1 Round 2

Decal ID	Date	Odometer	Fuel	MPG	CH_3CHO	CH_3OH	CH_4	CO	CO_2	HCHO	NMHCE	NO_x	THC	Evap. THC
AR206MS	11/10/95	10542	RFG	22.54	0.00019		0.021	1.03	384.4	0.00087	0.11	0.68	0.127	0.544
AR209MS	11/10/95	13729	RFG	22.71	0.00021		0.029	0.97	381.6	0.001	0.098	0.49	0.121	0.297
AR212MS	11/9/95	12339	RFG	22.55	0.00034		0.021	1.43	383.4	0.0017	0.119	0.54	0.136	0.214
DT203MS	5/8/95	9649	RFG	23.08	0.00034		0.035	2.42	374.9	0.00118	0.165	0.09	0.193	1.113
DT208MS	3/22/95	23698	RFG	23.32	0.00044		0.036	1.55	372.4	0.00146	0.125	0.24	0.153	1.859
DT211MS	3/15/95	8230	RFG	23.52	0.0004		0.031	1.15	369.9	0.00119	0.118	0.33	0.143	0.559
DT212MS	3/22/95	8890	RFG	23.14	0.00036		0.023	1.22	376	0.00108	0.115	0.11	0.133	1.365
DT219MS	6/20/95	29653	RFG	22.65	0.00045		0.031	1.82	381.2	0.00201	0.154	0.11	0.179	0.64
DT221MS	3/13/95	22279	RFG	24.27	0.00039		0.026	1.4	358.1	0.00129	0.113	0.13	0.134	0.358
DT223MS	3/17/95	26870	RFG	23.45	0.00048		0.041	2.43	368.9	0.00147	0.178	0.11	0.21	1.838
DT225MS	3/14/95	18864	RFG	23.66	0.00051		0.027	1.58	367.1	0.00142	0.126	0.12	0.148	0.845
DT226MSC	3/17/95	26907	RFG	23.18	0.00054		0.038	2.47	373.2	0.00185	0.164	0.22	0.194	1.136
DT229MS	6/21/95	17754	RFG	22.09	0.00031		0.028	1.17	392.1	0.00157	0.109	0.33	0.132	0.595
DT230MS	5/16/95	8776	RFG	22.6	0.00036		0.044	2.43	382.9	0.00111	0.198	0.08	0.233	0.415
DT233MS	5/5/95	9420	RFG	23.13	0.00035		0.051	3.1	372.8	0.00114	0.213	0.1	0.253	0.46
DT238MS	3/10/95	26976	RFG	22.89	0.00064		0.049	3.06	376.8	0.00208	0.195	0.3	0.234	0.374
DT241MS	5/22/95	9041	RFG	23.06	0.00027		0.026	1.56	376.7	0.00128	0.115	0.1	0.135	1.475
DT245MS	6/20/95	7672	RFG	22.49	0.00027		0.021	1.1	385.2	0.00136	0.114	0.11	0.131	1.495
DT250MS	3/13/95	21559	RFG	23.46	0.0004		0.027	1.48	370.3	0.00124	0.123	0.14	0.144	1.179
DT251MSC	6/21/95	27875	RFG	21.89	0.00037		0.037	2.56	393.3	0.00212	0.184	0.12	0.213	0.799
DT252MS	3/15/95	17927	RFG	23.72	0.00051		0.037	2.11	365.2	0.00154	0.152	0.15	0.181	1.06
	COUNT			21	21		20	21	19	21	21	21	21	21
	AVG			23.019	0.00039		0.0315	1.811	376.79	0.0014	0.1423	0.219	0.1679	0.8867
	STD DEV			0.572	0.00011		0.0082	0.673	9.183	0.00036	0.0349	0.169	0.041	0.5075
	CV			0.0248	0.285		0.2611	0.372	0.0244	0.249	0.2457	0.771	0.246	0.572

Table A-16. 1993 Standard Dodge Spirit: RFG Tests at Lab 3 Round 2

Decal ID	Date	Odometer	Fuel	MPG	CH_3CHO	CH_3OH	CH_4	CO	CO_2	HCHO	NMHCE	NO_x	THC	Evap. THC
DV201GSC	10/17/95	45797	RFG	24.89	0.0004		0.0112	2.013	344.98	0.0013	0.0913	0.5262	0.1022	0.3627
DV203GSC	2/9/96	32081	RFG	25.28	0.0003		0.0073	1.5135	340.50	0.001	0.0648	0.3923	0.072	0.2032
DV204GSC	2/13/96	28431	RFG	25.2	0.0003		0.012	2.1882	340.48	0.0011	0.0827	0.4545	0.0947	0.2684
DV205GSC	2/9/96	21702	RFG	23.76	0.0002		0.0097	1.7265	362.07	0.0012	0.0736	0.3397	0.0833	0.3773
DV208GSC	2/7/96	35723	RFG	25.28	0.0003		0.0117	2.3536	338.982	0.001	0.1051	0.4782	0.1168	0.4553
DV209GSC	9/29/95	32665	RFG	25.62	0.0003		0.0118	1.6075	335.77	0.0011	0.078	0.448	0.0894	0.1986
DV211GSC	10/30/95	28969	RFG	26.51	0.0004		0.0092	1.4337	324.71	0.0008	0.0812	0.3023	0.09	0.1705
DV212GSC	2/23/95	9467	RFG	24.58	0.0001		0.0493	1.4733	350.39	0.0007	0.0708	0.3442	0.0758	0.2235
DV213GSC	8/26/94	17661	RFG	25.2	0.0004		0.0136	2.0124	340.76	0.0009	0.0915	0.4202	0.102	0.2106
DV213GSC	8/30/94	17691	RFG	26.42	0.0006		0.0108	1.417	325.84	0.0018	0.0803	0.3696	0.0874	0.7326
Average				25.81	0.0005		0.0122	1.7148	333.30	0.00135	0.0825	0.3949	0.0947	0.4716
DV214GSC	10/25/95	21216	RFG	25.77	0.0005		0.006	1.6136	333.71	0.0008	0.0827	0.3934	0.0883	0.2307
DV215GSC	2/15/96	24493	RFG	26.10	0.0003		0.0102	1.6307	329.51	0.0011	0.088	0.3665	0.0984	0.2671
DV216GSC	11/22/95	21344	RFG	26.02	0.0004		0.0143	1.9511	329.99	0.0012	0.0785	0.4264	0.0926	0.1983
DV217GSC	10/4/95	41567	RFG	25.91	0.0004		0.0161	2.4568	330.56	0.001	0.0894	0.5074	0.1052	0.1835
DV219GSC	11/28/95	47989	RFG	24.59	0.0004		0.0116	1.4986	350.088	0.0013	0.0723	0.5618	0.0835	0.1198
DV220GSC	2/16/96	22416	RFG	23.57	0.0002		0.0064	1.5785	365.33	0.0007	0.064	0.352	0.0703	0.2559
DV221GSC	2/7/96	28027	RFG	23.43	0.0003		0.0097	1.4518	367.61	0.0011	0.0638	0.7279	0.0737	2.0176
DV222GSC	2/15/96	16295	RFG	25.87	0.0003		0.0077	1.5105	332.61	0.0008	0.0755	0.3948	0.0832	0.3267
DV223GSC	10/12/95	33618	RFG	23.59	0.0005		0.0096	1.7672	364.66	0.001	0.0721	0.6602	0.0812	0.4284
DV224GSC	9/12/95	38148	RFG	24.71	0.0003		0.0146	1.7943	347.89	0.0011	0.0867	0.3192	0.1013	0.1949
DV226GSC	2/20/96	13090	RFG	25.47	0.0002		0.0074	1.3653	338.10	0.0009	0.0789	0.4972	0.0864	0.2931
	COUNT			20	20		19	20	20	20	20	20	20	20
	AVG			25.099	0.00033		0.0104	1.732	343.06	0.001	0.079	0.444	0.089	0.3623
	STD DEV			0.9299	0.00011		0.0028	0.3108	13.185	0.0002	0.0102	0.1118	0.012	0.402
	CV			0.037	0.3275		0.2678	0.1794	0.038	0.1904	0.129	0.2516	0.1347	1.1096

Table A-17. 1993 FFV Dodge Spirit: M85 Tests at Lab 3 Round 2

Decal ID	Date	Odometer	Fuel	MPG	CH_3CHO	CH_3OH	CH_4	CO	CO_2	HCHO	NMHCE	NO_x	THC	Evap. THC
DV205MS	10/18/95	20922	M85	14.94	0.0005	0.1758	0.0152	2.0845	328.57	0.0115	0.1429	0.4377	0.0747	1.2286
DV206MS	12/5/95	15864	M85	14.68	0.0003	0.1899	0.0152	2.7763	333.43	0.0097	0.1368	0.1825	0.063	0.5508
DV207MS	10/3/95	26750	M85	13.24	0.0003	0.2457	0.0213	2.7213	317.91	0.0121	0.1629	0.1344	0.0703	3.3838
DV208MS	10/24/95	22635	M85	14.86	0.0004	0.1377	0.0072	1.5443	331.17	0.0088	0.1037	0.0963	0.046	0.5554
DV209MS	10/11/95	33179	M85	14.28	0.0004	0.1801	0.0123	1.7827	344.30	0.0113	0.1312	0.1507	0.0581	1.8408
DV211MS	12/7/95	29850	M85	14.66	0.0001	0.1673	0.0133	1.5714	335.79	0.0121	0.1269	0.229	0.0599	5.6498
DV212MS	11/14/95	17920	M85	15.15	0.0003	0.1645	0.0161	1.4523	324.88	0.0141	0.132	0.5411	0.0687	0.341
DV220MS	12/21/95	24371	M85	15.47	0.0002	0.2242	0.014	1.8115	317.70	0.0097	0.1303	0.1361	0.041	0.2556
DV226MS	12/6/95	16717	M85	15.08	0.0005	0.1711	0.0147	2.5551	324.85	0.0081	0.1227	0.2012	0.0575	0.6656
DV227MS	11/15/95	18738	M85	15.32	0.0003	0.0554	0.0134	1.3521	321.50	0.0078	0.0893	0.4285	0.0739	0.5787
DV229MS	10/19/95	34407	M85	14.05	0.0004	0.1416	0.0158	2.2514	349.34	0.0131	0.1443	0.4386	0.0908	0.3792
DV230MS	12/18/95	23075	M85	14.27	0.0002	0.1763	0.0151	2.0679	344.19	0.0095	0.1243	0.3165	0.0571	0.7603
DV231MS	8/17/95	35780	M85	12.81	0.0002	0.1809	0.0226	3.4275	327.51	0.0109	0.1466	0.2736	0.0841	0.4278
DV233MS	8/22/95	38506	M85	11.72	0.0002	0.1581	0.0184	2.5778	359.86	0.0154	0.0931	0.3726	0.0343	0.2211
DV242MS	2/8/95	8746	M85	12.76	0.0001	0.1224	0.0137	1.1271	332.43	0.0069	0.0997	0.2761	0.0556	0.737
DV244MS	11/16/95	18290	M85	15.38	0.0003	0.2023	0.012	1.9702	319.21	0.0117	0.1259	0.126	0.0434	0.4081
DV246MS	12/13/95	14491	M85	15.26	0.0002	0.2064	0.0134	1.7786	322.08	0.009	0.1242	0.1716	0.0424	5.8978
DV248MS	11/7/95	18349	M85	15.57	0.0003	0.184	0.0162	2.0714	315.27	0.0094	0.1234	0.1469	0.054	0.5876
DV249MS	11/28/95	20873	M85	15.03	0.0003	0.2064	0.0143	2.1499	326.57	0.0119	0.1266	0.2586	0.0445	0.7706
DV251MS	12/1/95	29497	M85	15.64	0.0004	0.1981	0.017	2.3808	313.25	0.009	0.1506	0.228	0.0753	0.3673
DV257MS	2/21/96	34214	M85	13.97	0.0002	0.21	0.01	1.851	352.09	0.0061	0.1414	0.1951	0.0556	0.1305
DV258MS	2/28/96	30096	M85	14.01	0.0002	0.1763	0.0129	1.6333	351.24	0.0108	0.1321	0.4119	0.0616	0.8146
	COUNT			22	22	22	20	21	22	21	21	20	21	22
	AVG			14.46	0.00029	0.176	0.015	1.977	331.51	0.0104	0.1279	0.251	0.0604	1.2069
	STD DEV			1.042	0.00011	0.039	0.0035	0.4562	13.33	0.0023	0.0188	0.1142	0.0145	1.6329
	CV			0.072	0.3929	0.2226	0.235	0.231	0.040	0.224	0.1467	0.4542	0.2394	1.353

Table A-18. 1993 FFV Dodge Spirit: RFG Tests at Lab 3 Round 2

Decal ID	Date	Odometer	Fuel	MPG	CH_3CHO	CH_3OH	CH_4	CO	CO_2	HCHO	NMHCE	NO_x	THC	Evap. THC
DV205MS	10/17/95	20896	RFG	23.93	0.0008		0.0414	2.719	356.77	0.0028	0.4036	0.3213	0.4431	3.7161
DV206MS	8/17/94	9955	RFG	22.81	0.0004		0.0297	1.035	378.1	0.0008	0.1214	0.4946	0.1486	0.3113
DV206MS	8/19/94	9988	RFG	23.39	0.0003		0.0311	1.325	368.3	0.0053	0.1169	0.5275	0.1433	*
Average				23.10	0.00035		0.0304	1.1798	373.22	0.00305	0.11555	0.511	0.14595	0.3113
DV207MS	10/5/95	26776	RFG	24.65	0.0006		0.0494	3.882	344.96	0.0017	0.1969	0.201	0.2459	3.9389
DV208MS	10/26/95	22617	RFG	23.45	0.0006		0.0324	3.0928	364.49	0.001	0.1423	0.0885	0.1744	0.4175
DV209MS	10/12/95	33205	RFG	22.94	0.0006		0.0441	2.7913	372.12	0.0016	0.4551	0.1675	0.4974	2.457
DV211MS	12/8/95	29876	RFG	23.46	0.0004		0.0211	1.7054	366.62	0.0016	0.1319	0.2056	0.1525	1.7463
DV212MS	11/10/95	17887	RFG	24.44	0.0004		0.0335	2.3053	350.74	0.0014	0.1408	0.6689	0.1738	0.3784
DV220MS	12/20/95	24344	RFG	26.79	0.0003		0.0183	1.9599	320.35	0.0054	0.1013	0.1539	0.1193	0.2984
DV226MS	12/5/95	16691	RFG	24.92	0.0004		0.0208	1.9311	344.49	0.0012	0.1455	0.1651	0.1657	0.6651
DV227MS	11/14/95	18711	RFG	24.73	0.0005		0.0177	1.5921	347.82	0.0014	0.1159	0.1932	0.133	0.7363
DV229MS	10/20/95	34433	RFG	22.87	0.0006		0.0285	1.8772	375.74	0.0022	0.1569	0.5304	0.1848	0.4242
DV230MS	12/13/95	23038	RFG	23.39	0.0005		0.0303	1.9915	367.18	0.0015	0.1199	0.4944	0.1497	0.8017
DV231MS	8/16/95	35753	RFG	23.79	0.0004		0.0458	4.264	357.23	0.0015	0.1622	0.2857	0.2077	0.3921
DV233MS	8/23/95	38355	RFG	21.90	0.0003		0.0491	2.598	390.71	0.0026	0.3526	0.3757	0.4001	0.3034
DV242MS	2/10/95	8791	RFG	24.22	0.0002		0.0233	1.381	355.47	0.0011	0.1464	0.1887	0.1425	0.7806
DV244MS	11/17/95	18316	RFG	25.01	0.0005		0.0325	2.6644	342.05	0.0014	0.1768	0.1394	0.2087	0.4404
DV246MS	12/12/95	14465	RFG	24.16	0.0004		0.0277	1.5717	355.76	0.0011	0.2499	0.1763	0.274	2.7281
DV248MS	11/8/95	18375	RFG	25.15	0.0005		0.0253	1.6251	341.81	0.0014	0.1466	0.1951	0.1716	0.7037
DV249MS	11/29/95	20900	RFG	24.66	0.0006		0.1848	1.7495	348.13	0.002	0.1064	0.2091	0.2926	0.5954
DV251MS	11/30/95	29470	RFG	25.13	0.0005		0.0316	2.2323	340.75	0.0015	0.2626	0.1661	0.2926	0.3436
DV257MS	2/20/96	34188	RFG	22.61	0.0004		0.0187	2.0275	379.95	0.0011	0.1464	0.1484	0.1654	0.5861
DV258MS	2/29/96	30122	RFG	22.78	0.0004		0.0187	1.4266	378.05	0.0011	0.1285	0.3244	0.1473	0.7097
	COUNT			22	22		20	21	22	21	21	20	21	22
	AVG			24.004	0.00047		0.0306	2.11	357.93	0.0016	0.1835	0.236	0.2197	1.0670
	STD DEV			1.111	0.00013		0.0105	0.656	16.549	0.0005	0.0998	0.1176	0.1068	1.112
	CV			0.0463	0.287		0.3443	0.3112	0.046	0.3565	0.5437	0.497	0.4863	1.0424

Table A-19. 1994-95 Standard Ford Taurus: RFG Tests at Lab 1 Round 1

Decal ID	Date	Odometer	Fuel	MPG	CH_3CHO	CH_4	CO	CO_2	ETOH	HCHO	NMHCE	NO_x	THC	Evap. THC
AR304GTC	7/11/95	3027	RFG	20.31	0.00023	0.011	0.8	427.4		0.00099	0.063	0.21	0.071	0.203
AR305GTC	11/2/95	12822	RFG	20.42	0.00023	0.012	1.14	424.3		0.00108	0.09	0.13	0.099	0.236
AR306GTC	12/12/95	5195	RFG	19.8	0.00029	0.016	1.62	436.9		0.00084	0.117	0.15	0.13	0.334
AR307GTC	12/15/95	4767	RFG	20.18	0.00025	0.014	1.13	429.4		0.00092	0.101	0.08	0.112	0.298
AR308GTC	12/13/95	4884	RFG	20.06	0.00025	0.012	1.39	431.7		0.00078	0.095	0.16	0.105	0.432
AR310GTC	12/18/95	5273	RFG	20.24	0.00026	0.014	1.56	427.4		0.00091	0.117	0.1	0.129	0.249
AR313GTC	2/19/96	3176	RFG	20.42	0.00022	0.012	1.3	424.1		0.00078	0.084	0.13	0.093	0.179
DT301GTC	8/11/95	3403	RFG	19.95	0.00029	0.011	0.82	435.2		0.001	0.073	0.13	0.082	0.215
DT302GTC	9/28/95	3359	RFG	20.13	0.00026	0.012	0.94	430.9		0.0011	0.082	0.09	0.091	0.309
DT303GTC	10/25/95	4157	RFG	20.35	0.00018	0.01	0.74	426.6		0.0009	0.064	0.15	0.072	0.23
DT304GTC	10/25/95	5601	RFG	20.19	0.00022	0.011	0.97	429.5		0.00096	0.083	0.09	0.091	0.239
DT305GTC	10/25/95	4060	RFG	20.34	0.00024	0.009	0.79	426.6		0.00098	0.079	0.11	0.086	0.182
DT306GTC	11/10/95	3775	RFG	20.17	0.00019	0.013	0.96	429.9		0.00071	0.096	0.06	0.106	0.186
DT308GTC	12/21/95	3929	RFG	20.2	0.00026	0.014	1.51	428.5		0.00086	0.098	0.08	0.109	0.276
DT311GTC	1/26/96	5076	RFG	19.98	0.0002	0.011	1.07	434		0.00066	0.075	0.14	0.084	0.316
DT314GTC	2/13/96	5241	RFG	19.95	0.00025	0.014	1.48	433.9		0.00086	0.101	0.11	0.112	0.218
	COUNT			16	16	16	16	16		16	16	16	16	16
	AVG			20.168	0.00024	0.0123	1.139	429.77		0.0009	0.0886	0.12	0.098	0.2564
	STD DEV			0.1818	0.00003	0.0018	0.3005	3.7905		0.00012	0.0163	0.0378	0.0178	0.0679
	CV			0.009	0.1332	0.1475	0.2638	0.0088		0.1382	0.1839	0.315	0.1808	0.265

Table A-20. 1994-95 FFV Ford Taurus: E85 Tests at Lab 1 Round 1

Decal ID	Date	Odometer	Fuel	MPG	CH_3CHO	CH_4	CO	CO_2	ETOH	HCHO	NMHCE	NO_x	THC	Evap. THC
AR309ET	3/30/95	6483	E85	14.82	0.01012	0.025	1.43	416.1	0.0749	0.00174	0.086	0.1	0.1	0.289
AR310ET	3/29/95	7363	E85	15.5	0.01281	0.032	1.29	397.9	0.0815	0.00221	0.098	0.11	0.115	0.397
AR314ET	5/2/95	4295	E85	15.45	0.00901	0.027	1.04	399.5	0.0593	0.00173	0.097	0.09	0.113	0.411
AR315ET	5/4/95	10253	E85	15.06	0.00935	0.028	1.31	409.4	0.0703	0.00204	0.104	0.11	0.12	0.369
AR316ET	5/1/95	8561	E85	15.16	0.00987	0.031	1.33	406.9	0.0708	0.00232	0.094	0.09	0.112	0.386
AR317ET	5/25/95	3067	E85	15.08	0.00627	0.021	1.01	409.4	0.0512	0.00204	0.076	0.13	0.089	0.271
AR318ET	5/15/95	3077	E85	15.1	0.00934	0.02	1.12	408.7	0.088	0.00209	0.101	0.08	0.111	0.308
AR319ET	5/16/95	3836	E85	15.24	0.00859	0.023	1.12	404.9	0.0655	0.00171	0.095	0.1	0.108	0.531
AR320ET	5/25/95	3076	E85	15.36	0.00859	0.024	1.21	401.6	0.0577	0.00156	0.086	0.08	0.1	0.325
AR321ET	5/17/95	3316	E85	15.36	0.00892	0.024	1.13	401.7	0.0666	0.00173	0.083	0.07	0.093	0.337
AR322ET	6/22/95	3217	E85	15.4	0.00885	0.029	1.41	400.3	0.0768	0.00244	0.088	0.13	0.105	0.242
AR323ET	7/14/95	7688	E85	15.29	0.00763	0.022	0.88	404.2	0.0626	0.00248	0.071	0.12	0.084	0.201
AR324ET	7/13/95	3328	E85	15.09	0.00889	0.023	1.04	409.1	0.0696	0.00207	0.086	0.1	0.099	0.3
AR325ET	9/13/95	3406	E85	15.17	0.00783	0.025	0.95	407	0.0832	0.00226	0.083	0.14	0.098	0.23
	COUNT			14	13	14	14	14	14	14	14	14	14	14
	AVG			15.22	0.009	0.0253	1.162	405.48	0.0698	0.0020	0.089	0.1036	0.1033	0.3284
	STD DEV			0.1862	0.0015	0.0036	0.1719	4.982	0.0104	0.00029	0.0094	0.021	0.0105	0.0864
	CV			0.0122	0.1692	0.144	0.1479	0.0123	0.1489	0.1454	0.1063	0.2025	0.1012	0.2632

Table A-21. 1994-95 FFV Ford Taurus: RFG Tests at Lab 1 Round 1

Decal ID	Date	Odometer	Fuel	MPG	CH_3CHO	CH_4	CO	CO_2	ETOH	HCHO	NMHCE	NO_x	THC	Evap. THC
AR309ET	3/29/95	6458	RFG	20.51	0.0004	0.014	1.24	424.6		0.00131	0.09	0.06	0.101	0.314
AR310ET	3/30/95	7389	RFG	20.66	0.00047	0.013	1.06	421.7		0.00122	0.089	0.11	0.1	0.348
AR314ET	5/1/95	4270	RFG	20.45	0.00099	0.016	1.02	426		0.0015	0.128	0.08	0.14	0.355
AR315ET	5/5/95	10278	RFG	20.46	0.00039	0.012	1.09	425.9		0.00132	0.093	0.12	0.103	0.415
AR316ET	5/3/95	8594	RFG	20.42	0.00024	0.011	1.13	426.6		0.00117	0.095	0.09	0.103	0.327
AR317ET	5/24/95	3042	RFG	20.4	0.00025	0.014	1.08	427.1		0.00125	0.086	0.16	0.096	0.31
AR318ET	5/12/95	3051	RFG	20.48	0.00022	0.009	0.97	425.6		0.00106	0.083	0.09	0.09	0.321
AR319ET	5/12/95	3810	RFG	20.65	0.00044	0.011	1.24	421.7		0.00134	0.1	0.11	0.109	0.335
AR320ET	5/24/95	3047	RFG	20.33	0.00038	0.012	1.21	428.3		0.00107	0.09	0.1	0.099	0.392
AR321ET	5/16/95	3291	RFG	20.31	0.00067	0.012	1.15	428.9		0.00112	0.098	0.07	0.108	0.338
AR322ET	6/21/95	3191	RFG	20.45	0.00032	0.014	1.17	423.7		0.00148	0.091	0.12	0.102	0.428
AR323ET	7/13/95	7654	RFG	20.26	0.0003	0.012	0.98	428.2		0.00137	0.077	0.2	0.086	0.266
AR324ET	7/14/95	3354	RFG	20.08	0.00043	0.01	0.87	432.2		0.00157	0.078	0.16	0.086	0.262
AR325ET	9/14/95	3432	RFG	20.14	0.00029	0.011	0.84	431		0.00131	0.076	0.28	0.085	0.23
	COUNT			14	13	14	14	14		14	14	14	14	14
	AVG			20.4	0.0004	0.0122	1.075	426.54		0.00129	0.091	0.125	0.1006	0.3315
	STD DEV			0.1665	0.00012	0.0018	0.1274	3.0876		0.00016	0.013	0.0588	0.014	0.0563
	CV			0.008	0.3294	0.1512	0.1185	0.0072		0.1215	0.143	0.4704	0.1378	0.1697

Table A-22. 1994-95 Standard Ford Taurus: RFG Tests at Lab 1 Round 2

Decal ID	Date	Odometer	Fuel	MPG	CH_3CHO	CH_4	CO	CO_2	ETOH	HCHO	NMHCE	NO_x	THC	Evap. THC
AR304GTC	8/5/96	25175	RFG	20.39	0.00028	0.014	1.49	425.2		0.00092	0.088	0.22	0.1	0.207
AR304GTC	8/6/96	25212	RFG	20.55	0.00028	0.013	1.34	422		0.00086	0.08	0.22	0.091	0.106
Average				20.47	0.00028	0.0135	1.415	423.6		0.00089	0.084	0.22	0.0955	0.1565
AR305GTC	7/1/96	31503	RFG	20.77	0.00031	0.015	1.65	417.1		0.00128	0.111	0.19	0.123	0.159
AR306GTC	10/16/96	11930	RFG	20.61	0.00027	0.012	1.07	421.2		0.00109	0.071	0.24	0.081	0.258
AR307GTC	10/4/96	12192	RFG	20.42	0.00023	0.013	1.18	425.1		0.00094	0.082	0.13	0.092	0.352
AR308GTC	10/8/96	12167	RFG	21.01	0.00023	0.013	1.12	413		0.0009	0.087	0.18	0.097	0.223
AR310GTC	10/16/96	11682	RFG	21.05	0.00024	0.015	1.31	412.1		0.00114	0.096	0.13	0.108	0.261
AR313GTC	10/24/96	8055	RFG	20.6	0.00031	0.013	1.13	421.3		0.001	0.093	0.14	0.103	0.255
DT301GTC	9/3/96	15635	RFG	20.41	0.00026	0.013	1.15	425.2		0.00094	0.085	0.17	0.096	0.168
DT301GTC	9/4/96	15688	RFG	20.47	0.00024	0.013	1.02	424.2		0.0009	0.073	0.21	0.084	0.13
Average				20.44	0.00025	0.013	1.085	424.7		0.00092	0.079	0.19	0.09	0.149
DT302GTC	7/18/96	9478	RFG	20.65	0.00034	0.014	1.57	419.6		0.00111	0.108	0.12	0.119	0.288
DT303GTC	9/9/96	11683	RFG	20.29	0.00019	0.012	1.21	427.7		0.00068	0.084	0.18	0.094	0.259
DT304GTC	7/15/96	12700	RFG	20.73	0.00029	0.011	0.99	419		0.00109	0.086	0.1	0.095	0.157
DT305GTC	9/9/96	12208	RFG	20.32	0.00021	0.012	1.25	426.9		0.00082	0.089	0.16	0.098	0.194
DT305GTC	9/10/96	12226	RFG	20.33	0.00019	0.012	1.14	426.9		0.00083	0.085	0.16	0.094	0.156
Average				20.325	0.0002	0.012	1.195	426.9		0.000825	0.087	0.16	0.096	0.175
DT306GTC	9/6/96	12053	RFG	20.72	0.00022	0.012	0.93	419.2		0.00086	0.082	0.15	0.092	0.14
DT306GTC	9/10/96	12071	RFG	20.52	0.00019	0.012	1.31	422.7		0.00074	0.085	0.13	0.095	0.144
Average				20.62	0.000205	0.012	1.12	420.95		0.0008	0.0835	0.14	0.0935	0.142
DT308GTC	7/15/96	11241	RFG	20.37	0.00026	0.012	1.44	425.7		0.00088	0.104	0.17	0.113	0.179
DT311GTC	7/15/96	14840	RFG	20.1	0.00029	0.013	1.38	431.5		0.00116	0.086	0.28	0.096	0.139
DT314GTC	9/20/96	14681	RFG	20.59	0.00024	0.012	0.91	422		0.00089	0.076	0.18	0.086	0.153
	COUNT			16	16	16	16	16		16	16	16	16	16
	AVG			20.565	0.00026	0.0128	1.2359	421.97		0.001	0.0886	0.1718	0.0989	0.2066
	STD DEV			0.2516	0.00004	0.0011	0.207	5.1633		0.00016	0.0112	0.0469	0.0115	0.0646
	CV			0.0122	0.1668	0.0873	0.1675	0.0122		0.1618	0.1264	0.273	0.1167	0.3128

Table A-23. 1994-95 FFV Ford Taurus: E85 Tests at Lab 1 Round 2

Decal ID	Date	Odometer	Fuel	MPG	CH_3CHO	CH_4	CO	CO_2	ETOH	HCHO	NMHCE	NO_x	THC	Evap. THC
AR309ET	35494	19297	E85	15.38	0.01201	0.059	2.2	399.5	0.1168	0.00316	0.128	0.29	0.168	0.203
AR310ET	3/7/97	18574	E85	14.89	0.01135	0.051	1.4	413.8	0.1159	0.00316	0.128	0.45	0.161	0.435
AR314ET	6/11/96	16529	E85	15.51	0.01666	0.03	1.48	397.1	0.0744	0.00265	0.198	0.15	0.216	0.341
AR315ET	6/11/96	28678	E85	15.03	0.01752	0.051	2.33	408	0.198	0.00358	0.314	0.29	0.347	0.415
AR316ET	6/13/96	29184	E85	15.58	0.01694	0.037	1.5	395.1	0.1639	0.00329	0.184	0.16	0.207	0.38
AR317ET	11/11/96	8211	E85	15.32	0.01025	0.031	1.22	402.7	0.1154	0.002	0.112	0.13	0.13	0.282
AR317ET	11/12/96	8247	E85	15.67	0.01148	0.026	1.33	393.4	0.1981	0.00214	0.134	0.1	0.144	0.308
Average				15.495	0.010865	0.0285	1.275	398.05	0.15675	0.00207	0.123	0.115	0.137	0.295
AR318ET	10/16/96	11104	E85	15.62	0.00971	0.023	1.08	395.1	0.1401	0.00226	0.121	0.1	0.133	0.205
AR318ET	10/17/96	11122	E85	15.78	0.01007	0.023	1.06	391.1	0.1687	0.00248	0.116	0.11	0.128	0.236
Average				15.7	0.00989	0.023	1.07	393.1	0.1544	0.00237	0.1185	0.105	0.1305	0.2205
AR319ET	6/17/96	10956	E85	15.45	0.01708	0.03	1.37	398.7	0.1744	0.00318	0.189	0.11	0.206	0.38
AR320ET	11/15/96	9713	E85	15.73	0.00924	0.028	1.29	392	0.1149	0.00173	0.106	0.1	0.123	0.386
AR320ET	11/18/96	9750	E85	15.84	1087	0.025	1.14	389.4	0.1643	0.00213	0.117	0.11	0.13	0.667
Average				15.785	0.010055	0.0265	1.215	390.7	0.1396	0.00193	0.1115	0.105	0.1265	0.5265
AR321ET	6/13/96	14476	E85	15.67	0.01349	0.02	1.41	393	0.1483	0.0021	0.196	0.17	0.206	0.318
AR322ET	6/13/96	8158	E85	15.63	0.01379	0.039	1.81	393.5	0.0785	0.00302	0.162	0.15	0.187	0.367
AR323ET	6/6/96	19940	E85	15.53	0.0155	0.033	1.54	396.6	0.1331	0.00272	0.135	0.16	0.155	0.203
AR324ET	6/6/96	15327	E85	15.5	0.0164	0.033	1.53	397.4	0.1477	0.0051	0.138	0.14	0.158	0.716
AR325ET	8/29/96	15178	E85	15.22	0.0132	0.028	1.44	404.7	0.145	0.00255	0.153	0.16	0.167	0.282
AR325ET	9/9/96	15233	E85	15.24	0.0116	0.03	0.91	405.2	0.156	0.00357	0.154	0.18	0.171	0.241
Average				15.23	0.012405	0.029	1.175	404.95	0.1507	0.00306	0.1535	0.17	0.169	0.2615
	COUNT			14	13	14	14	14	14	14	14	14	14	14
	AVG			15.456	0.0136	0.035	1.5218	398.54	0.139	0.0029	0.163	0.1832	0.1838	0.3615
	STD DEV			0.2526	0.0028	0.0114	0.3646	6.3896	0.0341	0.0008	0.0529	0.09678	0.0554	0.1383
	CV			0.0163	0.204	0.325	0.2396	0.016	0.244	0.270	0.3252	0.5282	0.3017	0.383

Table A-24. 1994-95 FFV Ford Taurus: RFG Tests at Lab 1 Round 2

Decal ID	Date	Odometer	Fuel	MPG	CH_3CHO	CH_4	CO	CO_2	ETOH	HCHO	NMHCE	NO_x	THC	Evap. THC
AR309ET	3/6/97	19271	RFG	20.38	0.00047	0.023	1.73	425		0.00181	0.141	0.26	0.16	0.213
AR310ET	3/6/97	18548	RFG	20.48	0.00046	0.024	1.32	423.6		0.00202	0.121	0.27	0.141	0.548
AR314ET	6/10/96	16504	RFG	20.41	0.00041	0.015	1.68	424		0.00173	0.245	0.2	0.256	0.343
AR315ET	6/12/96	28689	RFG	20.27	0.00045	0.018	1.83	426.8		0.00195	0.163	0.22	0.177	0.343
AR316ET	6/12/96	29158	RFG	20.68	0.00035	0.017	1.76	418.4		0.00163	0.175	0.16	0.188	0.324
AR317ET	11/18/96	8311	RFG	20.71	0.00033	0.012	0.97	419.4		0.00115	0.09	0.17	0.1	0.386
AR317ET	11/20/96	8355	RFG	20.88	0.00028	0.012	0.9	416.2		0.0011	0.077	0.17	0.086	0.268
Average				20.795	0.000305	0.012	0.935	417.8		0.001125	0.0835	0.17	0.093	0.327
AR318ET	10/10/96	11042	RFG	20.95	0.00031	0.013	1.14	414.1		0.00124	0.107	0.1	0.117	0.25
AR318ET	10/11/96	11060	RFG	20.88	0.00026	0.012	1.06	415.7		0.00137	0.103	0.09	0.113	0.241
Average				20.915	0.000285	0.0125	1.1	414.9		0.001305	0.105	0.095	0.115	0.2455
AR319ET	6/14/96	10930	RFG	20.46	0.00045	0.014	1.6	423.2		0.00184	0.166	0.1	0.177	0.305
AR320ET	11/11/96	9627	RFG	20.38	0.00026	0.011	1.14	425.8		0.00104	0.099	0.1	0.109	0.391
AR320ET	11/12/96	9645	RFG	20.29	0.00019	0.012	1.08	427.9		0.00095	0.09	0.11	0.099	0.346
Average				20.335	0.000225	0.0115	1.11	426.85		0.000995	0.0945	0.105	0.104	0.373
AR321ET	6/14/96	14501	RFG	20.81	0.00038	0.014	1.66	416.1		0.00149	0.137	0.21	0.149	0.346
AR322ET	6/14/96	8183	RFG	20.69	0.00041	0.015	1.58	418.6		0.00153	0.142	0.16	0.154	0.323
AR323ET	6/5/96	19915	RFG	20.61	0.00032	0.015	1.38	420.7		0.00142	0.106	0.19	0.118	0.224
AR324ET	6/10/96	15360	RFG	19.92	0.0003	0.015	1.66	434.4		0.00124	0.228	0.14	0.24	0.304
AR325ET	8/14/96	15012	RFG	19.92	0.00038	0.015	1.82	434.7		0.0014	0.125	0.19	0.137	0.288
AR325ET	8/16/96	15049	RFG	20.38	0.00037	0.012	1.11	425.9		0.00163	0.09	0.24	0.1	0.219
Average				20.15	0.00037	0.0135	1.465	430.3		0.00151	0.1075	0.215	0.1185	0.2535
	COUNT			14	13	14	14	14		14	14	14	14	14
	AVG			20.493	0.00037	0.0157	1.486	422.90		0.0015	0.1439	0.1782	0.1565	0.3194
	STD DEV			0.2772	0.000078	0.0038	0.2782	5.5736		0.00031	0.0481	0.0558	0.0484	0.0821
	CV			0.0135	0.2119	0.2395	0.1872	0.0132		0.1999	0.334	0.3129	0.3093	0.257

Table A-25. 1993 Standard Chevrolet Lumina: RFG Tests at Lab 2 Round 1

Decal ID	Date	Odometer	Fuel	MPG	CH_3CHO	CH_4	CO	CO_2	ETOH	HCHO	NMHCE	NO_x	THC	Evap. THC
DC202GLC	7/7/94	2981	RFG	19.18	0.00084	0.0377	3.1927	456.07		0.00447	0.1655	0.8232	0.1955	1.0974
DC203GLC	2/20/95	10253	RFG	19.33	0.00123	0.0506	3.9845	451.49		0.01191	0.2149	1.376	0.258	0.2209
DC205GLC	9/12/94	4379	RFG	18.42	0.00097	0.0437	4.5333	472.56		0.00463	0.2089	0.4146	0.2464	0.1343
DC206GLC	1/24/95	7996	RFG	18.62	0.00116	0.0409	4.371	468.05		0.007	0.2188	0.6438	0.2536	0.1736
DC207GLC	6/13/94	9405	RFG	19.43	0.00135	0.0348	3.33	449.6		0.0064	0.172	0.476	0.1996	0.1856
DC207GLC	6/14/94	9432	RFG	19.45	0.00122	0.0502	5.46	445.9		0.0051	0.204	0.381	0.2444	0.1899
Average				19.44	0.001285	0.0425	4.39835	447.74		0.00579	0.18815	0.42825	0.222	0.18775
DC208GLC	1/5/95	3098	RFG	18.21	0.00115	0.0363	3.5554	480.39		0.00589	0.1908	0.4593	0.2214	0.1572
DC209GLC	5/27/94	2903	RFG	20.14	0.00117	0.0336	2.579	435.1		0.0071	0.1804	0.71	0.207	0.114
DC209GLC	5/31/94	2930	RFG	19.83	0.0018	0.0335	2.558	442.5		0.0093	0.1582	0.609	0.185	0.208
Average				19.985	0.001485	0.03355	2.56845	438.8		0.008225	0.1693	0.65955	0.19605	0.161
DC210GLC	1/23/95	8767	RFG	18.94	0.00126	0.0365	3.7953	460.73		0.00657	0.1834	0.5661	0.2143	0.2003
DC211GLC	12/28/94	5906	RFG	18.44	0.00159	0.0331	3.6526	473.629		0.00551	0.1739	0.6723	0.2019	†
DC215GLC	6/28/94	3385	RFG	19.36	0.00084	0.0302	3.1609	451.95		0.00364	0.1659	0.485	0.1899	0.2456
DC218GLC	9/2/94	10713	RFG	18.76	0.0012	0.0386	4.1363	464.59		0.00603	0.194	0.466	0.2247	0.1445
	COUNT			11	11	11	11	11		11	11	10	11	10
	AVG			18.971	0.0012	0.0385	3.759	460.54		0.0063	0.1885	0.562	0.2203	0.2723
	STD DEV			0.539	0.00023	0.0057	0.6104	12.628		0.0022	0.0193	0.1341	0.0239	0.292
	CV			0.0284	0.1997	0.1485	0.1624	0.0274		0.3533	0.1022	0.239	0.1087	1.0724

Table A-26. 1992-93 FFV Chevrolet Lumina: E85 Tests at Lab 2 Round 1

Decal ID	Date	Odometer	Fuel	MPG	CH_3CHO	CH_4	CO	CO_2	ETOH	HCHO	NMHCE	NO_x	THC	Evap. THC
DC206EL	6/16/94	8338	E85	13.69	0.02616	0.0549	1.673	451.4	0.0768	0.0087	0.0957	0.179	0.112	0.1345
DC206EL	6/17/94	8365	E85	13.85	0.02401	0.0504	1.527	446.5	0.0991	0.0082	0.0906	0.219	0.097	0.1586
Average				13.77	0.025085	0.05265	1.59975	448.93	0.08795	0.00845	0.09314	0.19915	0.1043	0.14655
DC211EL	8/1/94	10411	E85	13.93	0.02265	0.0594	2.452	441.7	0.0929	0.00757	0.09882	0.1994	0.115	0.1634
DC218ELC	8/26/94	10778	E85	13.4	0.01456	0.0635	2.7832	459.30	0.0727	0.00439	0.09469	0.1196	0.1231	0.1213
DC219ELC	1/19/95	10613	E85	13.37	0.01961	0.0523	1.7598	461.91	0.0644	0.00928	0.08218	0.1295	0.1018	0.1897
DC221EL	7/27/94	10224	E85	13.8	0.01342	0.0752	3.2155	444.92	0.1143	0.00789	0.11528	0.1684	0.1417	0.0732
DC225EL	1/25/95	8939	E85	13.07	0.01816	0.0303	2.1375	471.90	0.0797	0.00763	0.08156	0.1523	0.078	0.199
DC227ELC	8/17/94	11151	E85	13.8	0.01347	0.0598	2.7002	445.56	0.0612	0.00703	0.08598	0.134	0.115	0.1726
DC229EL	9/20/94	10033	E85	13.5	0.01729	0.046	1.4359	457.54	0.0779	0.00551	0.06054	0.1802	0.0714	0.2016
DC230EL	10/7/94	8218	E85	13.53	0.01848	0.0681	1.9388	455.86	0.065	0.00511	0.0751	0.117	0.1086	0.1592
DC231EL	8/22/94	12409	E85	13.24	0.01489	0.0613	2.025	466.3	0.0758	0.00573	0.1064	0.125	0.132	0.3292
	COUNT			9	9	9	9	9	9	9	9	9	9	8
	AVG			13.574	0.0181	0.0564	2.2247	454.18	0.0796	0.00698	0.0875	0.1555	0.1065	0.1534
	STD DEV			0.2740	0.004	0.0131	0.601	9.7299	0.0169	0.0016	0.0155	0.0326	0.0216	0.041
	CV			0.0202	0.2216	0.2332	0.2701	0.0214	0.2124	0.2343	0.1775	0.21	0.2028	0.2659

Table A-27. 1992-93 FFV Chevrolet Lumina: RFG Tests at Lab 2 Round 1

Decal ID	Date	Odometer	Fuel	MPG	CH_3CHO	CH_4	CO	CO_2	ETOH	HCHO	NMHCE	NO_x	THC	Evap. THC
DC206EL	6/14/94	8296	RFG	18.12	0.00113	0.0428	3.307	483.1		0.00604	0.1356	0.197	0.17	0.1691
DC206EL	6/20/94	8400	RFG	18.27	0.00088	0.033	2.122	481.2		0.00428	0.1252	0.236	0.152	0.1506
Average				18.195	0.00100	0.0379	2.71455	482.1379		0.00516	0.1304	0.2164	0.1606	0.15985
DC211EL	7/29/94	10376	RFG	18.63	0.00135	0.0418	3.0465	469.9074		0.00654	0.1429	0.2311	0.1762	0.1507
DC218ELC	8/30/94	10849	RFG	17.79	0.0006	0.0282	2.8616	492.5368		0.00273	0.1007	0.2686	0.1232	0.202
DC219ELC	1/17/95	10544	RFG	18.03	0.00061	0.0264	1.2194	489.3387		0.00718	0.0964	0.2995	0.1188	0.2806
DC221EL	7/29/94	10293	RFG	18.06	0.0004	0.0282	1.9395	487.4542		0.00383	0.086	0.3324	0.1085	0.1059
DC225EL	1/24/95	8904	RFG	17.4	0.00064	0.0225	1.6005	505.6165		0.00461	0.0952	0.328	0.1148	0.09
DC227ELC	8/15/94	11081	RFG	18.24	0.00059	0.026	2.6576	481.1846		0.00387	0.0942	0.2248	0.1149	0.0882
DC229EL	9/21/94	10067	RFG	18.21	0.00068	0.0223	1.3119	484.3811		0.00229	0.0781	0.2455	0.0971	0.1922
DC230EL	6/16/95	14668	RFG	18.32	0.00072	0.0202	1.264	480.7151		0.00573	0.0915	0.203	0.1076	0.1199
DC231EL	8/24/94	12444	RFG	18.05	0.00052	0.0278	2.005	487.4		0.0031	0.1036	0.193	0.1257	0.2203
	COUNT			9	9	9	9	9		9	9	9	9	8
	AVG			18.097	0.00073	0.0282	2.0684	485.92		0.0047	0.1017	0.2610	0.1246	0.1624
	STD DEV			0.3469	0.00028	0.0072	0.7522	9.8003		0.0017	0.0211	0.0486	0.0262	0.0623
	CV			0.0192	0.3831	0.2568	0.3636	0.0202		0.3553	0.2073	0.1863	0.2102	0.3829

Table A-28. 1993 Standard Chevrolet Lumina: RFG Tests at Lab 2 Round 2

Decal ID	Date	Odometer	Fuel	MPG	CH_3CHO	CH_4	CO	CO_2	ETOH	HCHO	NMHCE	NO_x	THC	Evap. THC
DC202GLC	7/11/95	6826	RFG	19.13	0.00092	0.0386	3.3524	457.23		0.00518	0.1979	0.8413	0.2287	0.6901
DC203GLC	3/8/96	17084	RFG	20.21	0.00088	0.0441	4.7191	429.70		0.00498	0.1951	1.0044	0.2302	0.1091
DC205GLC	11/30/95	10105	RFG	19.8	0.00103	0.0464	4.6601	439.03		0.0035	0.3053	0.4898	0.3422	0.1589
DC206GLC	1/31/96	13420	RFG	19.58	0.00084	0.034	3.5337	446.34		0.00438	0.2092	0.7099	0.2363	0.1733
DC207GLC	5/26/95	13071	RFG	18.94	0.00177	0.0461	5.4588	458.17		0.0075	0.2512	0.5286	0.288	0.1136
DC208GLC	2/15/96	9445	RFG	19.48	0.00088	0.0361	3.7509	447.75		0.00376	0.202	0.5505	0.2307	0.568
DC209GLC	7/10/95	6956	RFG	19.14	0.00088	0.0465	3.7942	455.85		0.00485	0.2089	0.4936	0.2459	0.3673
DC210GLC	2/14/96	17618	RFG	19.85	0.00092	0.0428	4.6888	438.26		0.00433	0.2309	0.5516	0.265	0.1868
DC211GLC	12/20/95	12316	RFG	19.88	0.00086	0.039	3.6273	438.52		0.00516	0.1999	0.724	0.231	0.1165
DC215GLC	5/15/95	10965	RFG	18.81	0.00122	0.0416	3.9527	463.76		0.00675	0.189	0.4691	0.2242	0.183
DC218GLC	6/1/95	18970	RFG	19.44	0.0012	0.0492	4.969	446.53		0.00555	0.2157	0.4831	0.2549	0.1545
	COUNT			11	11	11	11	11		11	11	11	11	11
	AVG			19.478	0.0010	0.0422	4.2279	447.37		0.0051	0.2186	0.6223	0.2525	0.2565
	STD DEV			0.4384	0.00028	0.005	0.6932	10.486		0.0012	0.0338	0.1755	0.0355	0.199
	CV			0.0225	0.2675	0.1142	0.1639	0.023		0.2346	0.154	0.2819	0.1405	0.776

Table A-29. 1992-93 FFV Chevrolet Lumina: E85 Tests at Lab 2 Round 2

Decal ID	Date	Odometer	Fuel	MPG	CH_3CHO	CH_4	CO	CO_2	ETOH	HCHO	NMHCE	NO_x	THC	Evap. THC
DC206EL	6/22/95	12991	E85	13.82	0.02926	0.0993	3.9558	442.95	0.0973	0.01149	0.13669	0.3178	0.184	0.1681
DC211EL	8/5/96	28678	E85	14.41	0.01928	0.0908	4.249	424.11	0.0876	0.00623	0.12949	0.2528	0.1756	0.169
DC218ELC	6/7/95	24617	E85	14.18	0.02266	0.1036	4.9086	429.57	0.0851	0.00615	0.14352	0.1531	0.2003	0.0921
DC219ELC	6/16/96	17880	E85	13.54	0.0136	0.0551	1.8236	455.90	0.0592	0.00415	0.08526	0.1987	0.1107	0.2004
DC221EL	9/11/95	22408	E85	14.2	0.01297	0.072	3.3206	432.16	0.0858	0.00331	0.08567	0.2202	0.118	0.1519
DC225EL	6/27/96	16922	E85	14.14	0.01129	0.0416	2.1502	436.23	0.0688	0.00419	0.08338	0.1854	0.0951	0.1772
DC227ELC	7/10/96	35842	E85	14.44	0.01395	0.0745	3.152	425.22	0.0796	0.00346	0.10791	0.1808	0.1439	0.21
DC229EL	7/9/96	27166	E85	14.6	0.01186	0.069	2.1545	422.26	0.0799	0.00371	0.09439	0.2283	0.1262	0.1282
DC230EL	6/20/95	14695	E85	13.56	0.01849	0.0636	2.0234	455.10	0.0677	0.00737	0.08067	0.1138	0.1094	0.1534
DC231EL	6/6/95	24478	E85	13.27	0.0268	0.236	11.09	450.2	0.1325	0.007	0.2074	0.1256	0.363	0.1863
	COUNT			9	9	9	9	9	9	9	9	9	9	8
	AVG			14.099	0.017	0.0744	3.082	435.94	0.079	0.0056	0.105	0.2057	0.1404	0.1591
	STD DEV			0.3813	0.0059	0.0204	1.1156	12.802	0.0118	0.0026	0.0251	0.0589	0.0376	0.0378
	CV			0.0270	0.3508	0.2747	0.362	0.0294	0.149	0.4757	0.2383	0.2866	0.2682	0.2375

Table A-30. 1992-93 FFV Chevrolet Lumina: RFG Tests at Lab 2 Round 2

Decal ID	Date	Odometer	Fuel	MPG	CH_3CHO	CH_4	CO	CO_2	ETOH	HCHO	NMHCE	NO_x	THC	Evap. THC
DC206EL	6/21/95	12964	RFG	18.6	0.00117	0.0546	4.1236	468.59		0.00767	0.1747	0.3672	0.2182	0.1748
DC211EL	8/6/96	28704	RFG	19.43	0.00118	0.0492	4.5941	448.45		0.00393	0.1357	0.3365	0.1748	0.2333
DC218ELC	6/8/95	24644	RFG	19.24	0.001	0.0236	1.8161	457.47		0.00481	0.0962	0.2941	0.115	0.1103
DC219ELC	6/17/96	17907	RFG	18.03	0.00058	0.0237	1.2778	488.83		0.00264	0.0787	0.3235	0.0975	0.3557
DC221EL	9/12/95	22435	RFG	19.19	0.00066	0.0278	2.5216	457.36		0.00253	0.1141	0.4089	0.1363	0.1201
DC225EL	6/26/96	16895	RFG	19.17	0.00061	0.0269	1.6901	459.26		0.003	0.0894	0.2904	0.1108	0.1095
DC227ELC	7/8/96	35816	RFG	19.08	0.00063	0.0228	1.7157	461.36		0.00412	0.0984	0.2924	0.1165	0.4131
DC229EL	7/11/96	27193	RFG	19.22	0.00059	0.0261	1.4904	458.16		0.00256	0.0914	0.3751	0.1122	0.2058
DC230EL	12/2/96	25119	RFG	19.01	0.00062	0.0222	1.64	463.15		0.00399	0.106	0.2764	0.1237	0.3215
DC231EL	6/5/95	24451	RFG	17.78	0.00076	0.052	5.382	488.8		0.00509	0.174	0.325	0.215	0.1711
	COUNT			9	9	9	9	9		9	9	9	9	8
	AVG			18.997	0.00078	0.0308	2.3188	462.516		0.0039	0.1094	0.3294	0.1339	0.2418
	STD DEV			0.4277	0.00026	0.0122	1.2102	11.24		0.0016	0.0295	0.0459	0.0385	0.1112
	CV			0.0225	0.3284	0.3967	0.5219	0.0243		0.4153	0.2694	0.1394	0.2878	0.460

Table A-31. 1993 Standard Chevrolet Lumina: RFG Tests at Lab 2 Round 3

Decal ID	Date	Odometer	Fuel	MPG	CH_3CHO	CH_4	CO	CO_2	ETOH	HCHO	NMHCE	NO_x	THC	Evap. THC
DC202GLC	12/3/96	12606	RFG	19.6	0.0012	0.0519	5.614	442		0.0051	0.289	0.88	0.3304	0.9515
DC202GLC	12/4/96	12625	RFG	19.56	0.00099	0.044	4.425	444.6		0.00469	0.244	0.882	0.2786	1.929
Average				19.58	0.00109	0.04795	5.0195	443.33		0.004895	0.26635	0.8806	0.3045	1.44025
DC203GLC	2/7/97	23624	RFG	19.58	0.00112	0.0498	5.4366	442.79		0.00515	0.2425	0.777	0.2821	0.1425
DC205GLC	12/17/96	13632	RFG	20.11	0.00121	0.0406	4.2348	433.44		0.00538	0.234	0.4665	0.2663	0.263
DC206GLC	1/21/97	15937	RFG	18.53	0.00117	0.0335	3.9654	470.95		0.00465	0.2219	0.5354	0.2486	0.3996
DC207GLC	12/11/96	25036	RFG	20.11	0.00114	0.0494	6.6103	429.04		0.00504	0.2551	0.5343	0.2944	0.1983
DC208GLC	12/31/96	16210	RFG	19.08	0.00106	0.0658	6.3726	452.70		0.00447	0.3216	0.5909	0.3739	0.1814
DC209GLC	1/16/97	11365	RFG	19.74	0.00129	0.0405	4.3047	440.71		0.00541	0.2309	0.6621	0.2631	0.184
DC210GLC	12/16/96	22244	RFG	18.49	0.00115	0.0438	5.2616	470.22		0.00509	0.235	0.5838	0.2699	0.3229
DC211GLC	12/10/96	19479	RFG	19.88	0.00116	0.0398	3.733	439.3		0.0048	0.1927	0.7847	0.2244	0.3796
DC211GLC	12/11/96	19498	RFG	19.82	0.0011	0.0388	3.949	440.3		0.0054	0.2033	0.7852	0.2342	0.2952
Average				19.85	0.00113	0.0393	3.8407	439.82		0.00508	0.198	0.78495	0.2293	0.3374
DC215GLC	11/2/95	15403	RFG	19.44	0.00108	0.0487	4.9376	446.88		0.00418	0.2306	0.4743	0.2694	0.0973
DC218GLC	1/23/97	37902	RFG	20	0.00125	0.0517	6.3134	432.33		0.00613	0.2783	0.655	0.3194	0.3456
	COUNT			11	11	11	11	11		11	11	11	11	11
	AVG			19.501	0.0012	0.0465	5.1179	445.66		0.0050	0.247	0.631	0.2837	0.3556
	STD DEV			0.5769	7.13E-05	0.0085	0.9897	14.031		0.0005	0.033	0.1352	0.0391	0.3722
	CV			0.0296	0.0618	0.1832	0.1934	0.0315		0.1029	0.1336	0.214	0.1377	1.0464

Table A-32. 1992-93 FFV Chevrolet Lumina: E85 Tests at Lab 2 Round 3

Decal ID	Date	Odometer	Fuel	MPG	CH_3CHO	CH_4	CO	CO_2	ETOH	HCHO	NMHCE	NO_x	THC	Evap. THC
DC206EL	2/5/97	19700	E85	14.74	0.01867	0.0687	1.9598	417.502	0.0914	0.00676	0.12006	0.4431	0.1461	0.1502
DC211EL	2/21/97	34399	E85	13.61	0.02658	0.0725	3.2296	451.16	0.1214	0.00809	0.13241	0.2338	0.1501	0.1631
DC218ELC	11/19/96	41326	E85	13.64	0.01449	0.0784	4.465	448.2	0.1006	0.00397	0.1436	0.184	0.1766	0.1807
DC218ELC	11/20/96	41345	E85	13.69	0.01704	0.0806	4.695	445.9	0.0933	0.00375	0.1651	0.1844	0.2013	0.1444
Average				13.665	0.015765	0.0795	4.5799	447.06	0.09695	0.00386	0.15434	0.1842	0.18895	0.16255
DC219ELC	11/7/96	22155	E85	13.54	0.01289	0.0685	3.0595	454.02	0.0727	0.00371	0.08971	0.1915	0.123	0.1942
DC221EL	1/24/97	37950	E85	13.7	0.01783	0.0672	3.4155	447.55	0.0697	0.0058	0.12677	0.2797	0.1583	0.1484
DC225EL	1/28/97	19962	E85	13.99	0.02014	0.0395	1.8418	440.86	0.0883	0.00599	0.09768	0.2102	0.0989	0.1524
DC227ELC	12/30/96	42538	E85	13.16	0.01923	0.0619	2.3662	468.35	0.1124	0.00554	0.12559	0.1872	0.1392	0.1494
DC229EL	11/8/96	29758	E85	14.37	0.01323	0.0696	2.6712	427.76	0.0858	0.0042	0.0991	0.22	0.1292	0.2304
DC230EL	11/27/96	25092	E85	13.96	0.01749	0.0636	2.445	440.77	0.0922	0.00446	0.11357	0.1459	0.1353	0.1067
DC231EL	7/2/96	35946	E85	13.47	0.0318	0.292	18.294	430.6	0.2358	0.0033	0.379	0.0999	0.551	0.2221
	COUNT			9	9	9	9	9	9	9	9	9	9	8
	AVG			13.859	0.018	0.0657	2.8409	443.89	0.0923	0.0054	0.1177	0.2328	0.141	0.1631
	STD DEV			0.4717	0.0041	0.0110	0.8469	14.801	0.0167	0.0015	0.0202	0.0872	0.0249	0.0363
	CV			0.0340	0.2279	0.1682	0.2981	0.0333	0.1807	0.2723	0.171	0.3744	0.177	0.2228

Table A-33. 1992-93 FFV Chevrolet Lumina: RFG Tests at Lab 2 Round 3

Decal ID	Date	Odometer	Fuel	MPG	CH_3CHO	CH_4	CO	CO_2	ETOH	HCHO	NMHCE	NO_x	THC	Evap THC
DC206EL	2/4/97	19673	RFG	19.61	0.00083	0.0508	2.5923	446.63		0.00401	0.1419	0.5285	0.1823	0.1212
DC211EL	2/22/97	34425	RFG	18.13	0.00095	0.0474	4.4354	481.01		0.00394	0.1457	0.3015	0.1834	0.2081
DC218ELC	11/21/96	41371	RFG	18.45	0.00061	0.0322	2.968	475		0.0025	0.1227	0.294	0.1483	0.1796
DC218ELC	11/22/96	41390	RFG	18.43	0.00053	0.0275	2.605	475.7		0.0022	0.1175	0.523	0.1394	0.3139
Average				18.44	0.00057	0.02985	2.78625	475.32		0.002385	0.1201	0.2733	0.14385	0.24675
DC219ELC	11/6/96	22129	RFG	18.12	0.00055	0.0241	1.6483	485.65		0.00242	0.0845	0.3221	0.1037	0.1223
DC221EL	1/22/97	37923	RFG	18.82	0.00063	0.0273	2.6481	465.75		0.00321	0.1289	0.4382	0.1506	0.1265
DC225EL	1/27/97	19935	RFG	19	0.00066	0.0266	1.7936	463.18		0.00408	0.0987	0.3439	0.1199	0.2387
DC227ELC	12/27/96	42511	RFG	18	0.00083	0.0249	1.6506	486.13		0.00355	0.1182	0.2774	0.138	0.1689
DC229EL	11/12/96	29792	RFG	19.37	0.00066	0.0272	1.7956	453.69		0.00263	0.106	0.4028	0.1276	0.3375
DC230EL	12/2/96	25119	RFG	19	0.00062	0.0222	1.64	463.15		0.00399	0.106	0.2764	0.1237	0.3215
DC231EL	7/1/96	35919	RFG	17.83	0.00085	0.0842	12.15	476.2		0.0044	0.416	0.168	0.483	0.234
	COUNT			9	9	9	9	9		9	9	9	9	8
	AVG			18.721	0.0007	0.0311	2.332	468.95		0.0033	0.1167	0.3516	0.141	0.2066
	STD DEV			0.5795	0.00013	0.0104	0.921	14.001		0.00072	0.0201	0.0881	0.0272	0.088
	CV			0.0309	0.1957	0.3351	0.3949	0.0299		0.2132	0.172	0.2507	0.1924	0.4259

Table A-34. 1992/94 Dodge B250 Van: CNG Tests at Lab 1 Round 1

Decal ID	Date	Odometer	Fuel	MPG	CH_3CHO	CH_4	CO	CO_2	HCHO	NMHC	NO_x	THC	Evap. THC
OH301CR	8/2/95	5508	CNG	12.07	0.00015	0.365	1.01	576.7	0.00186	0.018	0.09	0.382	0.134
OH302CR	7/27/95	6611	CNG	12.16	0.00013	0.258	0.71	573	0.00204	0.017	0.28	0.274	0.073
OH303CR	7/20/95	5372	CNG	14	0.00011	0.244	0.55	497.7	0.00169	0.027	0.32	0.27	0.06
OH304CR	7/25/95	5622	CNG	13.49	‡	0.252	0.75	516.6	‡	0.017	0.22	0.268	0.028
OH305CR	7/31/95	4913	CNG	12.28	0.00022	0.247	0.58	567.8	0.00247	0.019	0.24	0.265	0.061
OH306CR	7/20/95	3455	CNG	12.41	0.0002	0.232	0.43	562.2	0.00212	0.013	0.3	0.244	0.069
OH307CR	8/2/95	4883	CNG	12.41	0.0002	0.221	0.53	561.8	0.00204	0.013	0.34	0.233	0.097
OH308CR	7/25/95	6517	CNG	13.92	‡	0.279	0.58	500.5	‡	0.021	0.4	0.299	0.031
OH309CR	7/27/95	5433	CNG	13.98	0.00015	0.259	0.49	498.7	0.00203	0.018	0.4	0.275	0.022
OH310CR	7/31/95	5807	CNG	12.97	0.00017	0.346	0.88	536.6	0.00242	0.021	0.28	0.366	0.109
	COUNT			10	8	10	10	10	8	10	10	10	10
	AVG			12.969	0.00017	0.27	0.651	539.16	0.0021	0.018	0.287	0.2876	0.0684
	STD DEV			0.8044	0.00004	0.0477	0.1839	32.971	0.00026	0.0041	0.0914	0.049	0.0367
	CV			0.0620	0.2295	0.1766	0.282	0.0611	0.1251	0.222	0.3185	0.1704	0.536

Table A-35. 1992/94 Dodge B250 Van: RFG Tests at Lab 1 Round 1

Decal ID	Date	Odometer	Fuel	MPG	CH_3CHO	CH_4	CO	CO_2	HCHO	NMHC	NO_x	THC	Evap. THC
AR301GRC	8/15/95	36218	RFG	13.9	0.00111	0.078	5.76	616.4	0.00612	0.315	0.88	0.379	0.901
AR302GRC	9/8/95	43839	RFG	13.75	0.00113	0.088	5.73	623.4	0.00582	0.376	0.86	0.448	1.259
DT301GRC	9/18/95	23991	RFG	12.84	0.00069	0.065	3.86	671.5	0.00428	0.218	0.68	0.27	0.646
DT302GRC	9/18/95	26443	RFG	14.1	0.00095	0.074	5.37	608.1	0.00566	0.302	0.81	0.362	0.517
DT303GRC	9/21/95	34217	RFG	13.9	0.00094	0.072	4.91	617.8	0.00557	0.279	0.77	0.338	0.427
DT304GRC	9/27/95	25006	RFG	13.79	0.00143	0.073	5.62	621.6	0.00528	0.288	0.57	0.348	0.553
DT305GRC	9/26/95	36963	RFG	14.09	0.00128	0.076	4.68	610	0.0068	0.295	0.89	0.357	0.814
DT306GRC	4/1/96	107350	RFG	13.65	0.00253	0.106	9.31	621.4	0.01251	0.58	1.44	0.667	0.519
DT307GRC	4/2/96	32764	RFG	13.37	0.00119	0.083	6.92	639.5	0.00641	0.329	0.84	0.398	0.692
DT308GRC	4/19/96	30703	RFG	11.52	0.00126	0.069	3.99	749	0.00609	0.249	0.84	0.304	0.671
	COUNT			10	10	10	10	10	10	10	10	10	10
	AVG			13.491	0.0013	0.078	5.615	637.87	0.0064	0.323	0.858	0.387	0.6999
	STD DEV			0.7866	0.00049	0.0117	1.5826	43.148	0.0022	0.0999	0.227	0.1097	0.2431
	CV			0.0583	0.396	0.1496	0.2818	0.0676	0.3463	0.3092	0.2651	0.2834	0.3474

Table A-36. 1992/94 Dodge B250 Van: CNG Tests at Lab 2 Round 1

Decal ID	Date	Odometer	Fuel	MPG	CH_3CHO	CH_4	CO	CO_2	HCHO	NMHC	NO_x	THC	Evap. THC
DC202CR	4/20/94	4906	CNG	12.17	0.00032	0.6412	2.2326	533.57	0.00657	0.0258	0.3293	0.6639	●
DC202CR	4/21/94	4925	CNG	12.19	0.00035	0.5636	1.3078	535.40	0.00628	0.0227	0.5532	0.5835	●
Average				12.18	0.000335	0.6024	1.7702	534.49	0.006425	0.02425	0.44125	0.6237	●
DC203CR	11/15/94	4108	CNG	11.55	0.00032	0.6896	1.326	563.80	0.00725	0.067	0.633	0.756	1.4556
DC204CR	12/6/94	15026	CNG	11.82	0.00049	0.9928	3.6231	546.91	0.01322	0.0422	0.5234	1.0303	0.5909
DC208CR	4/12/94	4382	CNG	12.37	0.00032	0.535	1.416	527.49	0.0078	0.0364	0.3378	0.5698	●
DC208CR	4/13/94	4407	CNG	12.43	0.00026	0.5067	1.1212	524.71	0.00635	0.0344	0.4094	0.5396	●
Average				12.4	0.00029	0.52085	1.2686	526.10	0.007075	0.0354	0.3736	0.5547	●
DC210CR	11/29/94	9492	CNG	11.61	0.00038	0.8428	0.4693	562.36	0.00802	0.0413	1.2035	0.8805	0.2509
DC211CR	5/13/94	5481	CNG	11.73	0.00041	0.8629	1.8766	553.90	0.00733	0.0767	0.3722	0.9383	●
DC212CR	11/15/94	6595	CNG	11.11	0.00026	0.4438	1.5938	586.70	0.00884	0.039	0.2991	0.4821	0.0566
DC220CR	11/17/94	10091	CNG	11.53	0.00029	0.348	0.8387	566.82	0.00849	0.023	0.3908	0.37	0.1409
DC222CR	11/17/94	4771	CNG	11.6	0.00046	0.4692	0.8227	562.72	0.01268	0.0495	0.9348	0.5185	0.0532
DC223CR	12/1/94	10435	CNG	11.51	0.00042	0.6211	2.6836	564.40	0.00418	0.0429	0.528	0.6623	0.1617
NY201CR	10/27/94	3951	CNG	11.15	0.0004	1.2872	3.637	579.29	0.00332	0.0485	0.1366	1.3292	0.8547
NY202CR	10/28/94	7717	CNG	11.49	0.00041	0.9168	1.0538	566.96	0.01087	0.0464	0.7234	0.9594	0.085
	COUNT			12	12	12	12	12	12	12	12	12	9
	AVG			11.64	0.00037	0.7164	1.7469	559.54	0.0081	0.0447	0.5466	0.759	0.4055
	STD DEV			0.3684	0.00007	0.2717	1.0535	17.143	0.003	0.0153	0.2934	0.2765	0.4797
	CV			0.0316	0.1948	0.3792	0.6030	0.0306	0.3684	0.343	0.5367	0.364	1.183

Table A-37. 1992/94 Dodge B250 Van: RFG Tests at Lab 2 Round 1

Decal ID	Date	Odometer	Fuel	MPG	CH_3CHO	CH_4	CO	CO_2	HCHO	NMHC	NO_x	THC	Evap. THC
DC202GRC	7/26/94	11449	RFG	13.69	0.00142	0.0666	5.6306	636.58	0.00858	0.3003	0.8617	0.3533	0.5542
DC203GRC	8/11/94	5086	RFG	13.09	0.00104	0.0712	5.5072	667.49	0.00617	0.2808	0.8535	0.3375	0.3826
DC204GRC	1/25/95	8115	RFG	13.08	0.00159	0.0618	5.1202	667.91	0.01043	0.2472	0.8556	0.2984	0.4137
DC205GRC	1/19/95	3527	RFG	13.11	0.00151	0.0666	4.9574	667.07	0.0096	0.2624	0.7151	0.318	0.4613
DC208GRC	3/15/95	22195	RFG	13.32	0.00185	0.0799	6.7894	653.14	0.01309	0.2957	0.8748	0.3623	0.6277
DC209GRC	7/15/94	15312	RFG	13.84	0.00099	0.0584	3.8402	632.72	0.00626	0.2164	0.8525	0.2629	0.3249
DC209GRC	7/18/94	15339	RFG	13.71	0.00097	0.06	4.4795	638.04	0.0055	0.2366	0.7931	0.2843	0.3795
Average				13.775	0.00098	0.0592	4.15985	635.38	0.00588	0.2265	0.8228	0.2736	0.3522
DC210GRC	8/3/94	10916	RFG	13.57	0.00166	0.0734	4.6491	643.63	0.00632	0.3121	1.0212	0.3705	0.3539
DC211GRC	7/11/94	6277	RFG	13.78	0.00104	0.0581	4.4168	634.69	0.0047	0.2467	0.589	0.293	0.765
DC211GRC	7/12/94	6304	RFG	13.8	0.00112	0.0486	3.6444	635.37	0.00416	0.2457	0.5534	0.2844	0.6398
Average				13.79	0.00108	0.05335	4.0306	635.03	0.00443	0.2462	0.5712	0.2887	0.7024
NJ201GRC	10/13/94	20423	RFG	12.43	0.00244	0.096	8.1747	698.34	0.00518	0.4139	0.6588	0.4943	0.7744
NJ202GRC	10/12/94	12381	RFG	12.21	0.00234	0.0979	9.3336	709.17	0.00584	0.4342	0.6041	0.5164	0.8197
NJ203GRC	10/14/94	15463	RFG	12.56	0.0021	0.0938	7.6116	692	0.006	0.3387	0.6483	0.4164	1.0386
NY201GRC	10/21/94	3550	RFG	12.23	0.00137	0.0598	4.5631	715.51	0.00663	0.265	0.3939	0.3151	0.7587
NY202GRC	10/20/94	13879	RFG	13.14	0.00288	0.0971	7.3946	660.98	0.00813	0.3497	1.0246	0.4303	0.8348
	COUNT			13	13	13	13	13	13	13	13	13	13
	AVG			13.076	0.0017	0.0751	5.994	667.86	0.0074	0.3056	0.762	0.3673	0.6211
	STD DEV			0.5652	0.00058	0.0161	1.6932	28.063	0.0024	0.0638	0.1831	0.0768	0.2202
	CV			0.0432	0.3416	0.2144	0.2825	0.0420	0.3308	0.209	0.2403	0.209	0.3546

Table A-38. 1992/94 Dodge B250 Van: CNG Tests at Lab 3 Round 1

Decal ID	Date	Odometer	Fuel	MPG	CH_3CHO	CH_4	CO	CO_2	HCHO	NMHC	NO_x	THC	Evap. THC
DV203CR	7/15/94	22245	CNG	13.41	0.0001	0.7312	0.394	506.89	0.0024	0.0354	1.6684	0.7666	●
DV203CR	7/17/94	22272	CNG	13.58	0.0001	0.7717	0.6207	499.83	0.0025	0.067	1.433	0.8387	●
Average				13.50	0.0001	0.75145	0.50735	503.36	0.00245	0.0512	1.5507	0.80265	●
DV204CR	2/16/95	5271	CNG	13.32	0.0007	1.6612	18.308	479.17	0.0108	0.1836	1.3804	1.8448	1.3659
DV205CR	5/16/94	10107	CNG	13.12	0.0001	0.7726	2.1214	515.08	0.0018	0.1487	0.2565	0.9213	●
DV205CR	5/18/94	10141	CNG	13.03	0.0002	0.905	1.3144	519.94	0.0023	0.0848	0.3631	0.9898	●
Average				13.07	0.00015	0.8388	1.7179	517.51	0.00205	0.11675	0.3098	0.95555	●
DV206CR	4/4/95	4522	CNG	13.19	0	0.5615	4.2485	509.89	0.0015	0.037	0.1124	0.5985	2.5033
DV208CR	6/15/94	4180	CNG	13.45	0.0002	0.4378	2.2634	503.42	0.0018	0.0257	0.2988	0.4635	●
DV209CR	6/10/94	3607	CNG	13.31	0.0001	0.4324	2.2416	508.89	0.0014	0.0223	0.1724	0.4547	●
DV210CR	7/1/94	4830	CNG	13.74	0.0001	0.4964	2.1915	492.38	0.0013	0.0531	0.2055	0.5495	●
DV211CR	3/7/95	4342	CNG	13.09	0	1.1719	7.3207	507.24	0.0017	0.0398	0.297	1.2117	0.2892
DV212CR	3/1/95	9514	CNG	15.55	0.0001	0.6196	0.7192	436.66	0.0018	0.0602	0.9169	0.6765	0.0877
DV214CR	3/14/95	5790	CNG	12.51	0.0001	0.5793	3.3715	539.26	0.0015	0.0408	0.1449	0.6201	0.5133
DV215CR	9/13/95	10252	CNG	13.92	0.0001	0.6129	1.2924	487.12	0.0014	0.0306	0.6804	0.6508	0.3211
DV217CR	4/27/94	4253	CNG	13.47	0.0001	0.6418	1.2116	503.54	0.0016	0.085	0.4094	0.7268	●
DV217CR	5/11/94	4302	CNG	13.15	0.0001	0.7071	0.8014	516.28	0.002	0.1214	0.5035	0.8285	●
Average				13.31	0.0001	0.67445	1.0065	509.91	0.0018	0.1032	0.45645	0.77765	●
DV218CR	3/7/95	5647	CNG	13.57	0	0.6082	2.4929	497.82	0.0012	0.0353	0.4935	0.6435	●
DV219CR	2/22/95	2121	CNG	12.84	0	0.4035	1.2628	529.33	0.0014	0.023	0.0858	0.4265	0.2223
DV220CR	4/11/95	7991	CNG	13.65	0.0002	1.061	5.2411	489.55	0.0022	0.0504	0.7511	1.1114	0.0587
	COUNT			14	14	14	14	14	14	14	13	14	7
	AVG			13.32	0.000089	0.6606	2.5627	502.31	0.00168	0.0492	0.3788	0.7102	0.5708
	STD DEV			0.3699	0.000068	0.2287	1.9156	23.752	0.00036	0.0283	0.2646	0.2398	0.8657
	CV			0.0278	0.7665	0.3461	0.7475	0.0473	0.2166	0.5752	0.6985	0.3377	1.5166

Table A-39. 1992/94 Dodge B250 Van: RFG Tests at Lab 3 Round 1

Decal ID	Date	Odometer	Fuel	MPG	CH_3CHO	CH_4	CO	CO_2	HCHO	NMHC	NO_x	THC	Evap. THC
DV203GRC	3/21/95	29165	RFG	14.00	0.0007	0.0625	4.3218	611.64	0.003	0.261	0.8026	0.3235	1.2378
DV204GRC	5/2/95	17831	RFG	13.25	0.0009	0.057	4.8186	646.09	0.0028	0.2798	0.5782	0.3368	0.9169
DV206GRC	3/17/95	10962	RFG	13.0	0.0006	0.0625	3.5236	660.96	0.0026	0.2294	1.1198	0.2919	0.8809
DV207GRC	3/28/95	17687	RFG	13.71	0.001	0.0553	4.0869	625.12	0.0036	0.2487	0.6583	0.304	1.3379
DV208GRC	3/17/94	10004	RFG	13.82	0.0022	0.051	4.2185	619.79	0.0055	0.3051	0.5599	0.3561	0.8638
DV208GRC	3/18/94	10030	RFG	13.72	0.0024	0.0471	3.5191	625.41	0.0074	0.3778	0.5957	0.4249	0.7558
Average				13.77	0.0023	0.04905	3.8688	622.60	0.00645	0.34145	0.5778	0.3905	0.8098
DV209GRC	4/18/95	10123	RFG	13.96	0.001	0.0459	3.58	614.97	0.0037	0.2206	0.4855	0.2665	1.5237
DV210GRC	4/13/95	30493	RFG	14.44	0.0013	0.0626	4.5459	592.49	0.0044	0.2664	0.686	0.329	1.3368
DV211GRC	4/20/95	27240	RFG	13.83	0.002	0.0656	4.4495	619.01	0.0065	0.3237	0.518	0.3893	1.6569
DV212GRC	5/26/94	3875	RFG	13.46	0.0008	0.0453	2.8978	639.08	0.0029	0.2102	0.5457	0.2555	1.5393
DV214GRC	4/27/95	7287	RFG	14.60	0.0006	0.0494	3.8342	587.02	0.0023	0.2305	0.6358	0.2799	1.1214
DV215GRC	4/8/94	4291	RFG	14.31	0.0009	0.0432	3.8976	599.21	0.0033	0.2873	0.594	0.3305	0.8125
DV215GRC	4/11/94	4325	RFG	14.03	0.0007	0.048	3.564	611.50	0.003	0.2524	0.6234	0.3004	0.6688
Average				14.17	0.0008	0.0456	3.7308	605.35	0.00315	0.26985	0.6087	0.31545	0.7407
DV216GRC	6/24/94	8937	RFG	13.86	0.0009	0.0513	4.009	618.43	0.0037	0.2549	0.9035	0.3062	0.4798
DV216GRC	6/28/94	8963	RFG	14.21	0.0008	0.0467	3.5984	603.63	0.0033	0.266	0.9029	0.3127	*
Average				14.04	0.00085	0.049	3.8037	611.03	0.0035	0.26045	0.9032	0.30945	0.4798
DV218GRC	5/9/95	4110	RFG	14.57	0.0007	0.0458	3.4402	589.13	0.0029	0.2317	0.7511	0.2775	0.4543
DV219GRC	5/11/95	4484	RFG	14.27	0.0008	0.0537	4.7317	599.35	0.0029	0.2355	0.8565	0.2892	0.5415
	COUNT			14	14	14	14	14	14	14	14	14	14
	AVG			13.934	0.001	0.0535	3.9738	615.99	0.0036	0.2578	0.695	0.3113	1.0413
	STD DEV			0.4768	0.00051	0.0074	0.5473	21.742	0.0013	0.0377	0.1758	0.041	0.409
	CV			0.0342	0.50067	0.138	0.1377	0.0353	0.3637	0.1464	0.2530	0.1311	0.393

Table A-40. 1992/94 Dodge B250 Van: CNG Tests at Lab 1 Round 2

Decal ID	Date	Odometer	Fuel	MPG	CH_3CHO	CH_4	CO	CO_2	HCHO	NMHC	NO_x	THC	Evap. THC
OH301CR	1/15/97	13434	CNG	11.75	0.00016	0.299	0.71	558	0.00212	0.02	0.22	0.318	0.655
OH302CR	6/24/97	14497	CNG	11.8	0.00016	0.325	0.54	556	0.00229	0.019	0.48	0.343	0.969
OH302CR	6/25/97	14516	CNG	11.82	0.00017	0.341	0.74	554.5	0.00249	0.023	0.49	0.363	0.054
Average				11.81	0.000165	0.333	0.64	555.25	0.00239	0.021	0.485	0.353	0.5115
OH303CR	8/5/97	12557	CNG	13.23	0.00031	0.368	0.61	495.3	0.00252	0.025	0.45	0.393	0.302
OH304CR	8/1/97	12467	CNG	13.69	0.00055	0.4	0.74	478.5	0.00237	0.028	0.5	0.426	0.105
OH305CR	12/2/96	11457	CNG	11.64	0.00015	0.458	0.87	562.9	0.00232	0.026	0.83	0.482	0.275
OH305CR	12/10/96	11503	CNG	11.57	0.00021	0.305	0.54	566.9	0.00254	0.017	0.55	0.315	0.157
Average				11.605	0.00018	0.3815	0.705	564.9	0.00243	0.0215	0.69	0.3985	0.216
OH306CR	7/18/97	8047	CNG	11.73	0.00039	0.423	1.57	557.2	0.00284	0.023	0.66	0.444	‡
OH307CR	12/10/96	9014	CNG	11.74	0.00016	0.208	0.38	559.6	0.00144	0.014	0.47	0.222	0.241
OH308CR	1/28/97	12246	CNG	13.43	0.00011	0.304	0.49	488.5	0.00154	0.023	0.35	0.326	0.73
OH309CR	7/11/97	12295	CNG	13.7	0.00016	0.513	0.61	477.9	0.00271	0.035	0.77	0.547	0.908
OH309CR	7/14/97	12325	CNG	13.5	0.00034	0.519	0.66	484.9	0.00289	0.027	0.82	0.541	0.899
Average				13.6	0.00025	0.516	0.635	481.4	0.0028	0.031	0.795	0.544	0.9035
OH310CR	7/14/97	15527	CNG	12.44	0.00035	0.39	0.86	526.7	0.00269	0.018	0.59	0.406	0.387
	COUNT			10	10	10	10	10	10	10	10	10	9
	AVG			12.503	0.00026	0.362	0.734	526.54	0.0023	0.0225	0.521	0.383	0.4501
	STD DEV			0.884	0.00014	0.083	0.3223	36.647	0.00048	0.0048	0.169	0.086	0.2677
	CV			0.0707	0.5229	0.2291	0.4391	0.0696	0.2097	0.2158	0.3243	0.224	0.5947

Table A-41. 1992/94 Dodge B250 Van: RFG Tests at Lab 1 Round 2

Decal ID	Date	Odometer	Fuel	MPG	CH_3CHO	CH_4	CO	CO_2	HCHO	NMHC	NO_x	THC	Evap. THC
AR301GRC	8/28/97	60261	RFG	12.41	0.0011	0.089	7.24	675.7	0.0049	0.345	0.94	0.416	0.823
DT301GRC	2/4/97	33050	RFG	13.76	0.00097	0.078	5.61	623.9	0.00491	0.331	0.89	0.393	0.729
DT302GRC	10/14/97	45288	RFG	13.91	0.00141	0.087	7.14	601.6	0.00624	0.363	0.79	0.436	0.531
DT303GRC	1/24/97	51733	RFG	14	0.00155	0.093	9.13	607.3	0.00713	0.416	0.99	0.491	0.647
DT303GRC	1/31/97	51772	RFG	14.08	0.00134	0.08	6.6	607.8	0.00592	0.391	0.86	0.455	0.896
Average				14.04	0.001445	0.0865	7.865	607.55	0.006525	0.4035	0.925	0.473	0.7715
DT304GRC	10/10/97	40152	RFG	13.91	0.00123	0.078	7.55	601.2	0.0055	0.345	0.78	0.409	1.026
DT305GRC	1/27/97	55239	RFG	13.88	0.00182	0.087	5.76	617.9	0.00804	0.388	1.1	0.458	1.301
DT307GRC	7/22/97	42417	RFG	13.54	0.00194	0.107	8.81	615.8	0.00753	0.408	1.19	0.494	1.294
DT307GRC	7/23/97	42436	RFG	15.13	0.00199	0.095	7.95	551	0.00828	0.368	0.83	0.443	1.159
Average				14.335	0.001965	0.101	8.38	583.4	0.007905	0.388	1.01	0.4685	1.2265
DT308GRC	2/6/97	37896	RFG	13.62	0.00106	0.075	5.22	631.5	0.00503	0.334	0.67	0.393	0.591
	COUNT			8	8	8	8	8	8	8	8	8	8
	AVG			13.733	0.0014	0.0852	6.846	617.84	0.0061	0.3622	0.8881	0.4308	0.8749
	STD DEV			0.5738	0.00036	0.0083	1.1637	27.784	0.0013	0.0278	0.1377	0.0328	0.2832
	CV			0.0418	0.2625	0.0972	0.17	0.045	0.2097	0.0767	0.155	0.0761	0.3237

Table A-42. 1992/94 Dodge B250 Van: CNG Tests at Lab 2 Round 2

Decal ID	Date	Odometer	Fuel	MPG	CH_3CHO	CH_4	CO	CO_2	HCHO	NMHC	NO_x	THC	Evap. THC
DC202CR	7/10/95	8077	CNG	11.77	0.00027	1.0776	1.7787	552.14	0.0066	0.0591	0.3925	1.1326	0.3865
DC203CR	12/15/95	5377	CNG	12.05	0.00046	1.1851	1.6078	539.25	0.00627	0.0824	0.6246	1.3641	0.205
DC204CR	12/12/95	23563	CNG	12.1	0.00039	1.9101	3.1705	532.28	0.00523	0.1335	1.5548	2.0382	0.0923
DC208CR	7/12/95	5926	CNG	12.06	0.00024	0.4939	1.094	541.20	0.00688	0.0792	0.3608	0.5748	0.215
DC210CR	1/23/96	18104	CNG	12.3	0.00032	1.2282	0.6899	528.53	0.00741	0.1032	1.4599	1.3292	0.5173
DC211CR	6/2/95	10857	CNG	11.01	0.00048	0.729	1.2682	592.05	0.00921	0.0424	0.3964	0.7688	0.4859
DC212CR	1/30/96	8943	CNG	11.79	0.00028	0.5537	2.6021	550.79	0.00452	0.046	0.1059	0.5987	0.3825
DC220CR	12/12/95	12084	CNG	11.84	0.0003	0.3754	1.3699	550.90	0.0034	0.0525	0.2371	0.4287	0.1117
DC222CR	12/13/95	7907	CNG	11.91	0.00032	0.6383	0.76	547.76	0.00519	0.0747	1.1319	0.7133	0.0464
DC223CR	7/31/96	24824	CNG	11.84	0.00068	0.8105	0.5811	551.26	0.00843	0.0371	1.5381	0.844	0.5274
NY201CR	2/15/96	5446	CNG	11.86	0.0004	1.3332	2.8986	544.71	0.00432	0.0912	0.3044	1.4206	0.7459
NY202CR	2/13/96	10233	CNG	12.14	0.00031	0.9478	1.4213	535.63	0.00559	0.0522	0.9742	0.9964	0.0871
	COUNT			12	12	12	12	12	12	12	12	12	12
	AVG			11.889	0.00037	0.9402	1.6035	547.21	0.0061	0.0711	0.757	1.017	0.3169
	STD DEV			0.3211	0.0001	0.4345	0.864	16.208	0.0017	0.029	0.5448	0.461	0.223
	CV			0.027	0.3313	0.462	0.5388	0.0296	0.2824	0.402	0.7199	0.4531	0.704

Table A-43. 1992/94 Dodge B250 Van: RFG Tests at Lab 2 Round 2

Decal ID	Date	Odometer	Fuel	MPG	CH_3CHO	CH_4	CO	CO_2	HCHO	NMHC	NO_x	THC	Evap. THC
DC202GRC	6/2/95	19331	RFG	13.82	0.00197	0.0855	6.9213	629.17	0.00861	0.3048	0.9641	0.3729	0.3121
DC203GRC	5/22/95	8642	RFG	13.45	0.00161	0.0749	5.8232	648.36	0.00651	0.3049	0.7	0.3675	0.9556
DC204GRC	2/22/96	14336	RFG	13.5	0.0011	0.0679	4.643	647.69	0.00416	0.2519	0.8829	0.3059	0.7377
DC205GRC	2/16/96	15101	RFG	13.7	0.00143	0.0757	5.7762	636.13	0.00416	0.3205	0.9657	0.3807	0.6805
DC208GRC	7/14/96	32165	RFG	13.6	0.00155	0.0747	5.894	641.21	0.00833	0.3048	1.0227	0.3643	0.7798
DC209GRC	6/21/95	29589	RFG	13.82	0.00207	0.0757	5.6656	631.34	0.01067	0.3023	1.0361	0.3626	0.5517
DC210GRC	6/23/95	21733	RFG	13.73	0.00243	0.0872	6.7691	632.93	0.0097	0.3373	0.9081	0.4067	0.5328
DC211GRC	8/10/95	13088	RFG	13.65	0.0012	0.0735	5.597	638.53	0.00742	0.2757	0.946	0.3342	0.8102
NJ201GRC	12/4/95	26407	RFG	13.37	0.00174	0.0936	7.4255	649.22	0.00564	0.4189	0.7576	0.4934	0.6908
NJ202GRC	12/7/95	15625	RFG	13.1	0.00143	0.0721	6.0946	664.82	0.00478	0.4052	0.6237	0.4626	0.9195
NJ203GRC	12/1/95	18925	RFG	13.29	0.00392	0.0817	6.4836	654.57	0.00521	0.3781	0.6344	0.4432	0.9907
NY201GRC	11/20/95	3834	RFG	12.57	0.00102	0.0512	4.18	697.47	0.00427	0.2516	0.4108	0.2924	1.0382
NY202GRC	11/27/95	19477	RFG	13.22	0.00121	0.0819	6.1239	659.46	0.00419	0.3732	0.6738	0.4384	1.442
	COUNT			13	12	13	13	12	13	13	13	13	13
	AVG			13.448	0.00156	0.0766	5.954	644.45	0.0064	0.3253	0.8097	0.3865	0.8032
	STD DEV			0.349	0.00043	0.0104	0.8767	11.457	0.0023	0.0543	0.1906	0.060	0.2807
	CV			0.0259	0.2734	0.1356	0.1473	0.0178	0.3556	0.167	0.2354	0.1553	0.3494

Table A-44. 1992/94 Dodge B250 Van: CNG Tests at Lab 3 Round 2

Decal ID	Date	Odometer	Fuel	MPG	CH_3CHO	CH_4	CO	CO_2	HCHO	NMHC	NO_x	THC	Evap. THC
DV203CR	1/9/96	29585	CNG	14.15	0.0004	0.4127	3.2595	476.28	0.003	0.2377	0.2578	0.6549	0.0842
DV204CR	1/5/96	6857	CNG	13.59	0.0016	1.34	15.203	472.9	0.0183	0.8451	1.476	2.2013	0.3189
DV205CR	8/17/95	22821	CNG	13.11	0.0001	1.0357	1.7903	515.42	0.0011	0.0524	0.5604	1.1005	0.5263
DV206CR	1/24/96	5368	CNG	13.21	0.0002	0.3879	3.7094	510.07	0.002	0.108	0.0985	0.5005	0.8637
DV208CR	3/20/95	10668	CNG	13.44	0.0001	0.5936	2.0116	503.78	0.0013	0.0275	0.7097	0.6211	0.2047
DV209CR	8/18/95	8275	CNG	12.92	0.0002	3.0291	3.6381	512.35	0.0019	0.9198	0.4321	3.9833	0.0422
DV209CR	8/21/95	8293	CNG	13.01	0.0001	2.6108	3.7372	510.17	0.0011	0.7764	0.3909	3.4128	0.1788
Average				12.96	0.00015	2.81995	3.68765	511.26	0.0015	0.8481	0.4115	3.69805	0.1105
DV210CR	3/21/95	6095	CNG	13.88	0	0.4579	2.9621	486.46	0.0011	0.0437	0.2087	0.5016	0.0672
DV211CR	1/19/96	7215	CNG	14.07	0.0003	0.6172	4.9885	475.70	0.0019	0.2347	0.3905	0.8595	0.0636
DV212CR	3/12/96	13753	CNG	13.91	0.0002	0.4719	0.6958	487.78	0.0024	0.3735	0.9728	0.8512	1.0647
DV214CR	3/27/96	11397	CNG	13.43	0.0002	0.2913	2.1117	503.92	0.0015	0.2545	0.3239	0.5494	0.1095
DV215CR	3/5/96	10679	CNG	13.64	0.0002	0.3277	0.4595	499.00	0.0017	0.1329	0.4992	0.4646	1.2486
DV217CR	8/22/95	13004	CNG	14.01	0.0002	1.0313	2.2387	481.46	0.0018	0.0572	0.7967	1.101	0.7193
DV218CR	5/1/96	11382	CNG	13.80	0.0002	0.8034	2.5954	488.26	0.002	0.2235	0.6712	1.0367	2.0798
DV219CR	1/10/96	12536	CNG	13.90	0.0002	0.3666	2.365	486.40	0.0014	0.2161	0.1536	0.5867	0.0849
DV220CR	3/15/96	11124	CNG	13.76	0.0003	0.4413	1.5352	492.08	0.0028	0.3642	1.0364	0.8108	0.1063
	COUNT			14	14	13	14	14	14	13	14	13	14
	AVG			13.663	0.0002	0.5568	2.458	494.13	0.0018	0.1789	0.506	0.7414	0.5238
	STD DEV			0.3727	0.0001	0.2515	1.214	13.096	0.0006	0.118	0.2975	0.2329	0.6087
	CV			0.0273	0.4938	0.4517	0.494	0.0265	0.3217	0.6594	0.5875	0.3142	1.162

Table A-45. 1992/94 Dodge B250 Van: RFG Tests at Lab 3 Round 2

Decal ID	Date	Odometer	Fuel	MPG	CH_3CHO	CH_4	CO	CO_2	HCHO	NMHC	NO_x	THC	Evap. THC
DV203GRC	2/23/96	32417	RFG	14.0	0.0013	0.0618	6.7021	607.78	0.0044	0.3835	0.8918	0.4459	0.9752
DV204GRC	3/21/96	19111	RFG	14.94	0.001	0.0315	3.8854	573.45	0.003	0.2923	0.3701	0.3242	1.1099
DV206GRC	1/30/96	13968	RFG	13.50	0.0011	0.0626	5.172	633.19	0.0038	0.2843	1.0141	0.3477	1.6591
DV207GRC	3/19/96	19818	RFG	13.65	0.0014	0.041	5.424	625.83	0.0047	0.369	0.6579	0.4106	1.0453
DV208GRC	3/15/95	13012	RFG	13.65	0.0006	0.049	3.773	628.74	0.0024	0.2383	0.556	0.2873	1.6412
DV209GRC	4/9/96	12982	RFG	13.87	0.0012	0.0476	3.3502	618.96	0.0043	0.268	0.6542	0.3162	1.4272
DV210GRC	1/12/96	36629	RFG	14.54	0.0013	0.0461	4.7842	587.92	0.0046	0.3187	0.8132	0.364	2.2384
DV211GRC	3/8/96	29480	RFG	14.19	0.0015	0.0643	6.2224	599.86	0.0054	0.3981	0.7168	0.4634	1.6088
DV212GRC	4/5/95	5210	RFG	13.85	0.0005	0.0504	3.5843	620.0	0.0026	0.2218	0.6065	0.2722	2.2984
DV214GRC	3/20/96	8913	RFG	13.712	0.0011	0.0343	4.1921	624.89	0.0034	0.3166	0.563	0.3512	2.2903
DV215GRC	8/24/95	11392	RFG	14.72	0.0007	0.0607	4.833	580.50	0.0028	0.2594	0.911	0.3191	0.3809
DV216GRC	1/24/96	15936	RFG	14.38	0.0013	0.0668	6.762	591.19	0.0049	0.3661	0.9499	0.4336	1.293
DV218GRC	4/30/96	17470	RFG	14.70	0.0009	0.0417	3.1454	584.11	0.0043	0.2482	0.8673	0.2904	0.906
DV219GRC	3/15/96	6394	RFG	14.49	0.0009	0.0317	4.1567	591.09	0.0033	0.2875	0.7662	0.3195	0.5852
	COUNT			14	14	14	14	14	14	14	14	14	14
	AVG			14.157	0.00106	0.0492	4.713	604.82	0.0038	0.304	0.7384	0.3532	1.3899
	STD DEV			0.4716	0.0003	0.0124	1.206	20.284	0.0009	0.0568	0.1815	0.0620	0.6089
	CV			0.0333	0.2891	0.251	0.2559	0.0335	0.2442	0.1869	0.2458	0.1756	0.4381

Table A-46. 1992/94 Dodge B250 Van: CNG Tests at Lab 2 Round 3

Decal ID	Date	Odometer	Fuel	MPG	CH_3CHO	CH_4	CO	CO_2	HCHO	NMHC	NO_x	THC	Evap. THC
DC202CR	11/4/96	11226	CNG	11.72	0.00031	0.6158	1.3536	556.29	0.0043	0.0404	0.5866	0.6543	0.0365
DC202CR	11/5/96	11245	CNG	11.7	0.00052	0.9355	1.5998	556.39	0.00466	0.0401	0.5165	0.9712	0.0555
Average				11.71	0.000415	0.7756	1.4767	556.34	0.00448	0.04025	0.55155	0.81275	0.046
DC203CR	12/9/96	10023	CNG	12.24	0.00052	1.4174	1.3417	530.40	0.00828	0.1	1.6841	1.5135	0.2903
DC204CR	11/25/96	30050	CNG	11.39	0.0007	2.5318	1.7748	565.59	0.00931	0.1104	1.7883	2.6305	0.1194
DC204CR	11/26/96	30068	CNG	11.61	0.00062	2.5934	1.2607	555.93	0.01111	0.1308	1.9197	2.7134	0.1062
Average				11.5	0.00066	2.5626	1.51775	560.76	0.01021	0.1206	1.854	2.67195	0.1128
DC208CR	1/6/97	7621	CNG	12.08	0.00024	0.7132	2.1283	538.26	0.00535	0.0706	0.4495	0.7832	0.073
DC210CR	1/15/97	24159	CNG	11.74	0.00067	0.9521	0.8176	554.99	0.00767	0.0607	1.1059	1.0098	0.4841
DC211CR	11/12/96	17163	CNG	11.62	0.0005	2.2048	0.1669	557.51	0.02523	0.1681	4.5083	2.3677	0.1828
DC212CR	12/13/96	12544	CNG	12	0.00041	0.4329	1.7739	543.49	0.005	0.04	0.2049	0.4724	0.4037
DC220CR	1/2/97	14209	CNG	12.09	0.00044	0.3895	1.2709	539.84	0.00459	0.0563	0.2806	0.4468	0.3341
DC222CR	12/23/96	15708	CNG	12.16	0.00048	1.8854	0.3883	533.77	0.01267	0.1212	2.7087	2.0007	0.0886
DC223CR	12/18/96	28104	CNG	11.99	0.00058	0.6873	0.9973	544.01	0.00875	0.0744	1.1205	0.7616	0.0955
NY201CR	12/27/96	6243	CNG	11.35	0.00049	1.162	3.5345	569.42	0.00587	0.0755	0.1694	1.2339	1.0165
NY202CR	12/26/96	10551	CNG	11.86	0.00058	1.1262	1.3038	547.74	0.00736	0.0742	0.8389	1.1969	0.0717
	COUNT			12	12	12	12	12	12	12	12	12	12
	AVG			11.862	0.0005	1.1924	1.393	548.045	0.0088	0.0835	1.2897	1.273	0.2666
	STD DEV			0.279	0.00012	0.6991	0.8697	11.833	0.0057	0.0377	1.272	0.7296	0.2779
	CV			0.0235	0.2378	0.5863	0.6243	0.0216	0.6526	0.4518	0.9867	0.5733	1.0423

Table A-47. 1992/94 Dodge B250 Van: RFG Tests at Lab 2 Round 3

Decal ID	Date	Odometer	Fuel	MPG	CH_3CHO	CH_4	CO	CO_2	HCHO	NMHC	NO_x	THC	Evap. THC
DC202GRC	11/14/96	34184	RFG	13.22	0.00201	0.0893	8.0457	655.95	0.0056	0.3813	1.0338	0.4524	1.1153
DC202GRC	11/15/96	34203	RFG	13.17	0.00225	0.0913	8.4206	657.82	0.00579	0.3878	1.0222	0.4605	0.7572
Average				13.195	0.00213	0.0903	8.23315	656.89	0.005695	0.38455	1.028	0.45645	0.93625
DC203GRC	8/8/96	13663	RFG	13.48	0.00124	0.0756	6.7742	645.36	0.0043	0.2984	1.0017	0.3586	1.601
DC204GRC	12/12/96	18645	RFG	13.42	0.0014	0.0723	6.388	648.53	0.00515	0.2969	0.8659	0.3544	0.7242
DC205GRC	12/4/96	23956	RFG	13.44	0.00162	0.0861	7.5648	646.27	0.00442	0.3348	1.0445	0.4034	1.2084
DC205GRC	12/5/96	23975	RFG	13.49	0.00157	0.0789	7.1964	644.43	0.00419	0.3284	0.964	0.3912	0.8702
Average				13.465	0.001595	0.0825	7.3806	645.35	0.004305	0.3316	1.00425	0.3973	1.0393
DC208GRC	1/10/97	33691	RFG	13.49	0.00172	0.0746	6.4265	645.20	0.00654	0.3288	0.9472	0.3882	0.9268
DC209GRC	1/7/97	57099	RFG	13.79	0.00212	0.0857	8.2844	627.68	0.00811	0.3745	1.1918	0.4427	0.4141
DC210GRC	1/14/97	41056	RFG	13.89	0.00271	0.0934	8.9268	622.44	0.00751	0.4586	1.0592	0.5329	0.8369
DC211GRC	1/17/97	23774	RFG	13.79	0.00157	0.0686	6.9849	630.30	0.00493	0.3164	0.9133	0.371	0.9305
NJ201GRC	12/19/96	29053	RFG	13.81	0.00206	0.085	7.5649	628.19	0.00734	0.3847	0.7192	0.4524	1.0741
NJ202GRC	12/20/96	19602	RFG	12.6	0.00173	0.0769	5.9418	692.49	0.00455	0.3606	0.5627	0.4218	1.1734
NJ203GRC	1/3/97	21990	RFG	12.82	0.00208	0.0863	6.0959	680.09	0.00611	0.4118	0.4941	0.4805	1.8371
NY201GRC	1/9/97	9363	RFG	12.94	0.00137	0.063	5.2188	675.19	0.00545	0.2897	0.4332	0.3398	1.0233
NY202GRC	1/13/97	25409	RFG	14.95	0.00379	0.0885	7.8023	579.37	0.00525	0.3452	0.8714	0.4156	1.2639
	COUNT			13	13	13	13	13	13	13	13	13	13
	AVG			13.511	0.00196	0.0802	7.079	644.39	0.0058	0.3524	0.853	0.416	1.060
	STD DEV			0.5919	0.00068	0.0091	1.0714	29.10	0.0013	0.0497	0.233	0.0559	0.363
	CV			0.0438	0.347	0.1136	0.1514	0.0451	0.217	0.141	0.2734	0.1344	0.3426

Table A-48. 1992/94 Dodge B250 Van: CNG Tests at Lab 3 Round 3

Decal ID	Date	Odometer	Fuel	MPG	CH_3CHO	CH_4	CO	CO_2	HCHO	NMHC	NO_x	THC	Evap. THC
DV203CR	9/5/96	36774	CNG	14.31	0.0003	0.4818	1.0882	474.34	0.0023	0.106	0.7334	0.5937	0.0779
DV204CR	9/24/96	9230	CNG	13.88	0.0014	1.6339	12.102	467.62	0.0196	0.4769	1.6314	2.1308	1.1548
DV204CR	9/25/96	9257	CNG	13.88	0.0013	1.5274	11.2897	469.10	0.0184	0.4334	1.6835	1.9794	0.8663
Average				13.88	0.00135	1.58065	11.69585	468.36	0.019	0.45515	1.65745	2.0551	1.01055
DV205CR	9/12/96	45147	CNG	13.31	0.0002	0.906	3.0784	505.39	0.0021	0.2262	0.6332	1.1434	1.2182
DV205CR	9/13/96	45159	CNG	13.27	0.0002	0.8958	2.838	507.29	0.0021	0.2425	0.6371	1.1491	2.9654
Average				13.29	0.0002	0.9009	2.9582	506.34	0.0021	0.23435	0.63515	1.14625	2.0918
DV206CR	10/25/96	6782	CNG	13.93	0.0002	0.266	1.8155	486.80	0.0013	0.0749	0.0944	0.3441	1.2241
DV208CR	1/26/96	16344	CNG	13.57	0.0003	0.6373	1.1734	499.46	0.0029	0.2496	1.0934	0.8947	1.4518
DV209CR	11/21/96	16896	CNG	13.82	0.0001	0.7146	4.4678	485.15	0.0014	0.1703	0.187	0.8936	0.5875
DV210CR	1/18/96	10209	CNG	13.85	0.0003	0.4776	1.4405	489.38	0.0016	0.1976	0.4876	0.681	2.4167
DV211CR	10/3/96	10093	CNG	13.88	0.0002	0.4733	2.9597	486.06	0.002	0.1141	0.2786	0.5931	0.3981
DV212CR	10/31/96	16705	CNG	13.75	0.0002	2.7378	1.069	487.44	0.0031	0.0898	1.624	2.861	0.0392
DV212CR	11/1/96	16731	CNG	13.76	0.0002	3.184	0.8535	486.14	0.003	0.1855	1.8426	3.4085	0.5714
Average				13.75	0.0002	2.9609	0.96125	486.79	0.00305	0.13765	1.7333	3.13475	0.3053
DV214CR	11/5/96	17501	CNG	13.44	0.0002	0.7419	1.872	503.02	0.0016	0.2024	0.5194	0.9534	0.2673
DV215CR	10/29/96	18805	CNG	14.36	0.0001	0.31	0.649	473.72	0.0014	0.0956	0.5512	0.4094	0.0095
DV217CR	9/18/96	21647	CNG	13.58	0.0002	1.0422	2.046	496.33	0.0018	0.2503	1.0635	1.3053	0.0381
DV217CR	9/19/96	21673	CNG	13.67	0.0002	0.8945	1.2252	495.08	0.0021	0.2349	1.0512	1.1402	1.9553
Average				13.62	0.0002	0.96835	1.6356	495.71	0.00195	0.2426	1.05735	1.22275	0.9967
DV218CR	10/29/96	12007	CNG	14.60	0.0002	1.0044	1.9796	461.33	0.0019	0.3087	0.8395	1.3253	0.0126
DV219CR	12/11/96	24274	CNG	13.36	0.0001	0.3712	1.6964	507.46	0.001	0.0928	0.1819	0.4685	0.6636
DV220CR	10/1/96	15313	CNG	14.22	0.0002	0.6807	0.8908	476.85	0.0016	0.1487	1.5328	0.8376	0.1985
	COUNT			15	14	13	14	14	14	14	14	13	14
	AVG			13.86	0.0002	0.6175	1.828	488.03	0.0019	0.1697	0.7089	0.797	0.7644
	STD DEV			0.382	0.000068	0.245	1.0285	13.514	0.00059	0.0713	0.4995	0.3145	0.774
	CV			0.0275	0.3397	0.3966	0.5627	0.028	0.314	0.420	0.7045	0.3945	1.013

Table A-49. 1992/94 Dodge B250 Van: RFG Tests at Lab 3 Round 3

Decal ID	Date	Odometer	Fuel	MPG	CH_3CHO	CH_4	CO	CO_2	HCHO	NMHC	NO_x	THC	Evap. THC
DV203GRC	11/19/96	34525	RFG	14.56	0.0012	0.0652	3.7451	588.47	0.0042	0.3683	0.7973	0.4343	1.4031
DV204GRC	11/13/96	19768	RFG	13.78	0.0009	0.0506	3.4684	623.01	0.003	0.2781	0.4379	0.3292	1.675
DV206GRC	10/31/96	15820	RFG	14.0	0.001	0.0602	3.45	613.11	0.0037	0.2943	1.1483	0.3553	0.019
DV207GRC	10/10/96	17662	RFG	14.25	0.0011	0.0634	5.1086	599.22	0.004	0.3666	0.6971	0.4308	1.3119
DV208GRC	3/7/96	15426	RFG	13.61	0.0011	0.0516	4.8743	628.38	0.0039	0.3073	0.6404	0.3595	0.9998
DV209GRC	9/24/96	15482	RFG	13.40	0.001	0.0528	3.6502	640.36	0.0035	0.2776	0.742	0.3309	1.0993
DV209GRC	9/26/96	15508	RFG	13.72	0.001	0.051	3.6794	625.25	0.0037	0.2778	0.7536	0.3294	1.0694
Average				13.56	0.001	0.0519	3.6648	632.81	0.0036	0.2777	0.7478	0.33015	1.0844
DV210GRC	10/22/96	38485	RFG	14.19	0.0012	0.0554	4.4815	602.83	0.0041	0.3233	0.7189	0.3795	1.9489
DV211GRC	10/8/96	31006	RFG	13.88	0.0013	0.0592	4.4585	616.88	0.0043	0.3463	0.7055	0.4061	1.9078
DV212GRC	4/2/96	6720	RFG	13.88	0.001	0.0443	3.3549	618.53	0.0038	0.2497	0.5861	0.2944	1.7316
DV214GRC	9/17/96	10361	RFG	14.36	0.0012	0.0543	3.9008	596.53	0.0041	0.3157	0.7033	0.3705	1.5589
DV214GRC	9/18/96	10387	RFG	14.29	0.0013	0.0587	4.4716	598.61	0.0042	0.3386	0.742	0.3979	1.6713
Average				14.33	0.00125	0.0565	4.1862	597.57	0.00415	0.32715	0.72265	0.3842	1.6151
DV215GRC	10/11/96	17425	RFG	14.40	0.0019	0.0547	3.9063	594.90	0.0071	0.3259	0.9212	0.3813	0.9225
DV215GRC	10/15/96	17452	RFG	14.46	0.0011	0.0549	3.8514	592.65	0.0042	0.2967	0.9605	0.3523	1.3422
Average				14.432	0.0015	0.0548	3.87885	593.78	0.00565	0.3113	0.94085	0.3668	1.1324
DV216GRC	11/14/96	20459	RFG	14.06	0.0009	0.0503	2.6234	611.72	0.0038	0.3003	1.0158	0.3513	0.7371
DV218GRC	11/21/96	24356	RFG	14.83	0.0008	0.0521	3.02	579.01	0.0031	0.2808	1.02	0.3334	0.9739
DV219GRC	11/22/96	7888	RFG	14.71	0.0008	0.0521	3.9684	582.19	0.0029	0.3029	0.934	0.3557	2.3532
	COUNT			14	14	14	14	14	14	14	14	14	14
	AVG			14.149	0.0011	0.0548	3.877	606.25	0.0039	0.3096	0.7938	0.365	1.3495
	STD DEV			0.3944	0.0002	0.0056	0.6966	16.974	0.00068	0.0343	0.1942	0.039	0.590
	CV			0.0279	0.1867	0.103	0.1797	0.028	0.176	0.111	0.2447	0.108	0.437

Table A-50. 1994 CNG Dodge Caravan: CNG Tests at Lab 2 Round 1

Decal ID	Date	Odometer	Fuel	MPG	CH_3CHO	CH_4	CO	CO_2	HCHO	NMHC	NO_x	THC	Evap HC
DC301CM	6/12/95	12373	CNG	18.4	0.00037	0.1402	0.2488	372.83	0.00499	0.0338	0.3662	0.174	0.5085
DC302CM	6/8/95	12618	CNG	17.91	0.00044	0.1711	0.3058	382.59	0.0062	0.036	0.4156	0.2071	0.2863
DC303CM	6/6/95	14282	CNG	18.25	0.00035	0.4413	0.2565	374.51	0.00782	0.0847	0.916	0.526	0.3931
DC306CM	8/7/95	4567	CNG	17.07	0.0002	0.0687	0.4745	402.42	0.00388	0.0117	0.0231	0.0804	0.1661
DC307CM	5/25/95	6279	CNG	17.33	0.00051	0.0925	0.367	396.11	0.00511	0.019	0.0402	0.1116	0.0537
DC309CM	8/4/95	4342	CNG	16.98	0.00032	0.1103	0.4371	403.98	0.00179	0.0201	0.0337	0.1303	0.0518
DC310CM	7/3/96	3817	CNG	16.97	0.00048	0.1159	0.4821	387.48	0.00277	0.0097	0.0175	0.1254	0.0438
DC311CM	12/8/95	4613	CNG	16.86	0.00024	0.1422	0.1941	390.24	0.00238	0.0065	0.257	0.1601	0.0763
DC313CM	8/14/95	4380	CNG	17.16	0.00016	0.0906	0.3843	400.44	0.0032	0.0122	0.0494	0.1028	0.7008
DC314CM	6/19/95	5052	CNG	17.65	0.00039	0.0853	0.3413	389.14	0.00588	0.0098	0.0587	0.0951	0.0474
DC317CM	7/21/96	4969	CNG	17.35	0.00039	0.0918	0.2962	378.82	0.00247	0.0125	0.153	0.1045	0.1419
DC318CM	7/14/95	4736	CNG	17.37	0.00016	0.1283	0.4597	395.39	0.00264	0.0177	0.0612	0.146	0.7374
DC320CM	7/5/95	4855	CNG	17.58	0.00017	0.1742	0.485	390.09	0.00334	0.0169	0.0408	0.1911	0.8388
	COUNT			13	13	13	13	13	13	13	13	13	13
	AVG			17.452	0.00032	0.1425	0.364	389.54	0.004	0.0224	0.1871	0.1657	0.3112
	STD DEV			0.489	0.00012	0.0955	0.0991	10.18	0.0018	0.0207	0.2574	0.1149	0.294
	CV			0.028	0.3849	0.6705	0.2723	0.0261	0.4493	0.9272	1.3757	0.6933	0.9448

Table A-51. 1994 Standard Dodge Caravan: RFG Tests at Lab 2 Round 1

Decal ID	Date	Odometer	Fuel	MPG	CH_3CHO	CH_4	CO	CO_2	HCHO	NMHC	NO_x	THC	Evap HC
DC321GMC	7/1/96	17617	RFG	18.37	0.00092	0.0281	1.6061	479.14	0.00378	0.1548	0.2917	0.1771	0.1794
DC322GMC	7/6/96	18415	RFG	18.8	0.00086	0.0242	1.6466	467.57	0.0033	0.1468	0.3391	0.1661	0.4018
DC323GMC	7/15/96	16366	RFG	18.72	0.00109	0.0284	1.6123	469.82	0.00385	0.1632	0.2603	0.1858	0.383
DC324GMC	7/18/96	15527	RFG	19.12	0.00087	0.0312	1.6844	459.71	0.00257	0.1324	0.2983	0.1572	0.3701
DC325GMC	7/23/96	20696	RFG	18.91	0.00082	0.0278	1.1659	466.32	0.00362	0.1423	0.3074	0.1644	0.3129
DC326GMC	7/28/96	18704	RFG	19.09	0.00085	0.0263	1.5939	460.74	0.00369	0.1441	0.2821	0.1651	0.2917
	COUNT			6	6	6	6	6	6	6	6	6	6
	AVG			18.835	0.0009	0.0277	1.5515	467.22	0.0035	0.1473	0.2965	0.1693	0.3232
	STD DEV			0.2766	0.0001	0.0023	0.1918	7.0448	0.00048	0.0106	0.0264	0.0103	0.0821
	CV			0.0147	0.1085	0.0842	0.1236	0.015	0.1383	0.0723	0.0889	0.0609	0.2542

shaded areas mark outliers or a data point removed to balance a FFV data set

† - missing data

‡ - instrument problems caused loss of data

* - evaporative test not required for re-tests resulting from a regulated emissions component being out of EPA standards

● - first tests on CNG vehicles did not include evaporative

Appendix B:
Speciated Compounds

Compound Number	Compound Name	CAS Number	Formula
1	METHANE	74828	CH4
2	ETHYLENE	74851	C2H4
3	ETHANE	74840	C2H6
4	ACETYLENE	74862	C2H2
5	PROPANE	74986	C3H8
6	PROPYLENE	115071	C3H6
7	PROPADIENE	463490	C3H4
8	METHYLACETYLENE	74997	C3H4
9	ISO-BUTANE	75285	C4H10
11	1-BUTENE	106989	C4H8
12	ISO-BUTYLENE	115117	C4H8
13	1,3-BUTADIENE	106990	C4H6
14	N-BUTANE	106978	C4H10
15	2,2-DIMETHYLPROPANE	463821	C5H12
16	TRANS-2-BUTENE	624646	C4H8
17	1-BUTEN-3-YNE	689974	C4H4
18	1-BUTYNE	107006	C4H6
19	CIS-2-BUTENE	590181	C4H8
20	*** UNKNOWN ***		C4H8
21	1,3-BUTADIYNE	460128	C4H2
22	3-METHYL-1-BUTENE	563451	C5H10
23	ISO-PENTANE	78784	C5H12
24	1,4-PENTADIENE	591935	C5H8
25	2-BUTYNE	503173	C4H6
26	1-PENTENE	109671	C5H10
27	C5H8		C5H8
28	2-METHYL-1-BUTEN-3-YNE	78808	C5H6
29	2-METHYL-1-BUTENE	563462	C5H10
30	N-PENTANE	109660	C5H12
31	ISOPRENE	78795	C5H8
32	TRANS-2-PENTENE	646048	C5H10
33	3,3-DIMETHYL-1-BUTENE	558372	C6H12
34	CIS-2-PENTENE	627203	C5H10
35	2-METHYL-2-BUTENE	513359	C5H10
36	TRANS-1,3-PENTADIENE	2004708	C5H8
37	CYCLOPENTADIENE	542927	C5H6
38	2,2-DIMETHYLBUTANE	75832	C6H14
39	CIS-1,3-PENTADIENE	1574410	C5H8
40	C5H8		C5H8
42	CYCLOPENTENE	142290	C5H8
44	4-METHYL-1-PENTENE	691372	C6H12
45	3-METHYL-1-PENTENE	760203	C6H12
45.501	*** UNKNOWN ***		
46	CYCLOPENTANE	287923	C5H10
48	2,3-DIMETHYLBUTANE	79298	C6H14
49	4-METHYL-CIS-2-PENTENE	691383	C6H12
51	2-METHYLPENTANE	107835	C6H14
52	4-METHYL-TRANS-2-PENTENE	674760	C6H12
53	C5H6		C5H6
54	C5H8		C5H8
55	*** UNKNOWN ***		C6H12
57	*** UNKNOWN ***		C6H12
58	3-METHYLPENTANE	96140	C6H14
59	2-METHYL-1-PENTENE	763291	C6H12
60	1-HEXENE	592416	C6H12
62	2-ETHYL-1-BUTENE	760214	C6H12
63	N-HEXANE	110543	C6H14
64	CIS-3-HEXENE	7642093	C6H12
64.501	TRANS-3-HEXENE	13269528	C6H12
65	TRANS-2-HEXENE	405045	C6H12
66	2-METHYL-2-PENTENE	625274	C6H12
66.501	3-METHYLCYCLOPENTENE	1120623	C6H10
67	CIS-3-METHYL-2-PENTENE	922623	C6H12
68	4-METHYLCYCLOPENTENE	1759815	C6H10
69	CIS-2-HEXENE	7688213	C6H12
70	C6H10		C6H10
72	TRANS-3-METHYL-2-PENTENE	616126	C6H12
72.501	2,2-DIMETHYLPENTANE	590352	C7H16
73	METHYLCYCLOPENTANE	96377	C6H12
76	2,4-DIMETHYLPENTANE	108087	C7H16
76.501	2,3-DIMETHYL-2-BUTENE	563791	C6H12
76.502	*** UNKNOWN ***		

Compound Number	Compound Name	CAS Number	Formula
77	2,2,3-TRIMETHYLBUTANE	464062	C7H16
78	C6H8		C6H8
79	C7H12		C7H12
79.501	*** UNKNOWN ***		
80	2,4-DIMETHYL-1-PENTENE	2213323	C7H12
80.501	*** UNKNOWN ***		
81	1-METHYLCYCLOPENTENE	693890	C6H10
82	BENZENE	71432	C6H6
83	4,4-DIMETHYL-2-PENTENE	26232984	C7H14
84	3,3-DIMETHYLPENTANE	562492	C7H16
84.501	*** UNKNOWN ***		
85	TRANS-2-METHYL-3-HEXENE	692240	C7H14
86	CYCLOHEXANE	110827	C6H12
88	C7H14		C7H14
89	4-METHYL-1-HEXENE	3769231	C7H14
91	TRANS-4-METHYL-2-HEXENE	3683225	C7H14
92	2-METHYLHEXANE	591764	C7H16
93	2,3-DIMETHYLPENTANE	565593	C7H16
94	*** UNKNOWN ***		C7H14
95	1,1-DIMETHYLCYCLOPENTANE	1638262	C7H14
96	3-METHYLHEXANE	58934	C7H16
96.501	CYCLOHEXENE	110838	C6H10
97	TRANS-5-METHYL-2-HEXENE	7385822	C7H14
97.501	*** UNKNOWN ***		
98	CIS-1,3-DIMETHYLCYCLOPENTANE	2532583	C7H14
99	TRANS-1,3-DIMETHYLCYCLOPENTANE	1759586	C7H14
100	TRANS-1,2-DIMETHYLCYCLOPENTANE	822504	C7H14
101	3,4-DIMETHYL-TRANS-2-PENTENE	4914925	C7H14
102	ISO-OCTANE	540841	C8H18
103	3-METHYL-TRANS-3-HEXENE	3899363	C7H14
104	TRANS-3-HEPTENE	14686147	C7H14
105	N-HEPTANE	142825	C7H16
106	CIS-3-METHYL-3-HEXENE	491489	C7H14
108	TRANS-2-HEPTENE	14686136	C7H14
109	3-ETHYL-2-PENTENE	816795	C7H14
109.501	C7H12		C7H12
110	2-METHYL-2-HEXENE	2738194	C7H14
111	1,5-DIMETHYLCYCLOPENTENE	16491159	C7H12
111.5	CIS-2-HEPTENE	6443921	C7H14
111.501	2,3-DIMETHYL-2-PENTENE	10574375	C7H14
111.502	3-ETHYL CYCLOPENTENE	694359	C7H14
112	4-ETHYL CYCLOPENTENE		C7H12
112.5	2,2-DIMETHYLHEXANE	590738	C8H18
112.501	1-CIS-2-DIMETHYLCYCLOPENTANE	1192183	C7H14
113	METYHLCYCLOHEXANE	108872	C7H14
114	1,1,3-TRIMETHYLCYCLOPENTANE		C8H16
115	C8H14		C8H14
116	C8H14		C8H14
118	2,5-DIMETHYLHEXANE	592132	C8H18
119	2,4-DIMETHYLHEXANE	589435	C8H18
119.501	2,2,3-TRIMETHYLPENTANE	564023	C8H18
119.502	3-METHYLCYCLOHEXENE	591480	C7H12
119.503	4-METHYLCYCLOHEXENE	591479	C7H12
120	1,2,4-TRIMETHYLCYCLOPENTANE	16883480	C8H16
120.501	3,3-DIMETHYLHEXANE	563166	C8H18
121	C8H16		C8H16
122	C8H14		C8H14
123	C,T,C-1,2,3-TRIMETHYLCYCLOPENTANE	15890401	C8H16
124	2,3,4-TRIMETHYLPENTANE	565753	C8H18
125	1-ETHYLCYCLOPENTENE	2146385	C7H12
125.502	2,3,3-TRIMETHYLPENTANE	560214	C8H18
126	TOLUENE	108883	C7H8
127	2,3-DIMETHYLHEXANE	584941	C8H18
127.501	C8H14		C8H14
128	2-METHYLHEPTANE	592278	C8H18
129	4-METHYLHEPTANE	589537	C8H18
130	3,4-DIMETHYLHEXANE	583482	C8H18
131	3-METHYLHEPTANE	589811	C8H18
131.501	3-ETHYLHEXANE	619998	C8H18
132	1,2,4-TRIMETHYLCYCLOPENTANE		C8H16
133	TRANS-1,4-DIMETHYLCYCLOHEXANE	2207047	C8H16
134	1,3-DIMETHYLCYCLOHEXANE		C8H16

Compound Number	Compound Name	CAS Number	Formula
135	2,2,5-TRIMETHYLHEXANE	3522949	C9H20
136	1-OCTENE	111660	C8H16
136.501	TRANS-1-ETHYL-3-METHYLCYCLOPENTANE	2613652	C8H16
137	CIS-1-ETHYL-3-METHYLCYCLOPENTANE	2613663	C8H16
138	C8H16		C8H16
139	C8H16		C8H16
140	C8H16		C8H16
141	N-OCTANE	111659	C8H18
142	C8H16		C8H16
142.501	TRANS-1,2-DIMETHYLCYCLOHEXANE	6876239	C8H16
143	1,1,2-TRIMETHYLCYCLOPENTANE	4259001	C8H16
143.501	1,2,3-TRIMETHYLCYCLOPENTANE	2613696	C8H16
144	C8H16		C8H16
145	2-OCTENE	111671	C8H16
146	ISOPROPYLCYCLOPENTANE	3875512	C8H16
147	*** UNKNOWN ***		C8H16
148	2,3,5-TRIMETHYLHEXANE	1069530	C9H20
149	C8H14		C8H14
160	2,4-DIMETHYLHEPTANE	2213232	C9H20
161	C8H14		C8H14
162	2,6-DIMETHYLHEPTANE	1072055	C9H20
163	n-PROPYLCYCLOPENTANE	2040962	C8H16
165	2,5-DIMETHYLHEPTANE	2216300	C9H20
165.501	3,5-DIMETHYLHEPTANE	926829	C9H20
165.502	C9H18		C9H18
166	1,1,4-TRIMETHYLCYCLOHEXANE		C9H18
167	C9H18		C9H18
167.501	C9H18		C9H18
167.502	C9H16		C9H16
167.503	C9H18		C9H18
168	ETHYLBENZENE	100414	C8H10
169	2,3-DIMETHYLHEPTANE	3074713	C9H20
170	3,4-DIMETHYLHEPTANE	922281	C9H20
171	M&P-XYLENE		C8H10
174	3-METHYLOCTANE	2216333	C9H20
176	C9H18		C9H18
177	C10H22		C10H22
177.501	STYRENE	100425	C8H8
178	1-NONENE	124118	C9H18
178.501	2-NONENE		C9H18
179	O-XYLENE	95476	C8H10
180	4-NONENE	2198234	C9H18
182	C9H18		C9H18
187	N-NONANE	111842	C9H20
188	C9H18		C9H18
190	C9H18		C9H18
193	C9H18		C9H18
194	C9H18		C9H18
195	ISOPROPYLBENZENE	98828	C9H12
196	C10H22 ?		C10H22
197	C10H22 ?		C10H22
197.501	C10H22 ?		C10H22
198	n-BUTYLCYCLOPENTANE		C9H18
199	C10H22 ?		C10H22
200	C10H22		C10H22
201	C9H18		C9H18
202	C10H22 ?		C10H22
202.501	*** UNKNOWN ***		C10H22
203	C10H20		C10H20
204	N-PROPYLBENZENE	103651	C9H12
206	1-METHYL-3-ETHYLBENZENE	620144	C9H12
207	1-METHYL-4-ETHYLBENZENE	622968	C9H12
209	1,3,5-TRIMETHYLBENZENE	108678	C9H12
210	C10H22		C10H22
211	C10H20		C10H20
212	C10H22		C10H22
212.501	C10H20		C10H20
213	1-METHYL-2-ETHYLBENZENE	611143	C9H12
214	C10H20		C10H20
215	C10H20		C10H20
216	C10H20		C10H20
217	o-METHYLSTYRENE	100801	C9H10
218	1,2,4-TRIMETHYLBENZENE	95636	C9H12
218.501	m-METHYLSTYRENE		C9H10
219	N-DECANE	124185	C10H22
219.5	C10H20		C10H20
219.501	C10H20		C10H20
219.502	*** UNKNOWN ***		
219.503	*** UNKNOWN ***		
220	2-METHYLPROPYLBENZENE	538932	C10H14
221	1-METHYLPROPYLBENZENE	135988	C10H14
222	C11H24		C11H24
222.501	1-METHYL-3-ISOPROPYLBENZENE	535773	C10H14
222.502	C11H24		C11H24
222.503	p-METHYLSTYRENE		C9H10
223	1,2,3-TRIMETHYLBENZENE	576738	C10H14
224	C11H24		C11H24
224.501	C10H20		C10H20
224.502	C11H24		C11H24
225	2,3-DIHYDROINDENE(INDAN)	496117	C9H10
225.501	C10H12		C10H12
226	C10H20		C10H20
227	1,3-DIETHYLBENZENE	141935	C10H14
229	1-METHYL-3-n-PROPYLBENZENE	1074437	C10H14
229.501	1-METHYL-4-n-PROPYLBENZENE	1074551	C10H14
230	1,2-DIETHYLBENZENE	135013	C10H14
230.501	n-BUTYLBENZENE	104518	C10H14
230.502	C11H24		C11H24
231	C11H24		C11H24
231.501	1,4-DIETHYLBENZENE	105055	C10H14
232	C11H24		C11H24
232.501	1,3-DIMETHYL-5-ETHYLBENZENE		C10H14
233	1-METHYL-2-n-PROPYLBENZENE	1074175	C10H14
233.501	C11H24		C11H24
234	1,4-DIMETHYL-2-ETHYLBENZENE	1758889	C10H14
235	1,3-DIMETHYL-4-ETHYLBENZENE	874419	C10H14
236	1,2-DIMETHYL-4-ETHYLBENZENE	934805	C10H14
236.501	o-ETHYLSTYRENE		C10H12
237	1,3-DIMETHYL-2-ETHYLBENZENE	2870044	C10H14
237.501	m-ETHYLSTYRENE		C10H12
238	C10H12		C10H12
239	C11H22		C11H22
240	n-UNDECANE	1120214	C11H24
240.501	C10H12		C10H12
241	C11H16		C11H16
241.501	C11H16		C11H16
242	1,2-DIMETHYL-3-ETHYLBENZENE		C10H14
243	C11H14		C11H14
243.501	C12H26		C12H26
245	1,2,4,5-TETRAMETHYLBENZENE	95932	C10H14
246	1,2,3,5-TETRAMETHYLBENZENE	527537	C10H14
247	C12H26		C12H26
247.501	*** UNKNOWN ***		
249	C11H16		C11H16
250	C11H16		C11H16
252	C11H16		C11H16
255	C10H12		C10H12
256	C11H16	5161046	C11H16
257	1-METHYL-1H-INDENE	767599	C10H10
258	C10H12		C10H12
259	C11H16		C11H16
260	C11H16		C11H16
261	C11H16		C11H16
262	C10H12		C10H12
263	C11H16		C11H16
263.501	*** UNKNOWN ***		
265	C11H14		C11H14
267	*** UNKNOWN ***		C11H16
268	NAPHTHALENE	91203	C10H8
268.501	C11H14		C11H14
269	n-DODECANE	112403	C12H26
330	MTBE	1634044	C5H12O
340	METHANOL	67561	CH4O
341	ETHANOL	108101	C2H6O

Appendix C:
Speciated Data Sets

Table C-1. 1995 FFV Dodge Intrepid: M85 Tests at Lab 1

Vehicle	Test date	Odometer	Fuel	HCHO	CH_3CHO	1,3-butadiene	benzene	VOC	NMOG	MIR	OFP	SR	Total Pwt
AR301MN	12/6/95	3575	M85	17.29	0.22	0.1	1.1	243.91	226.71	225.81	323.88	1.434	0.930
AR302MN	2/19/96	5524	M85	14.25	0.17	0.1	0.8	262.52	245.42	244.82	291.03	1.189	0.781
AR314GNC	1/7/97	12450	M85	16.65	0.24	0.1	1	279.09	259.29	258.29	320.89	1.242	0.898
AR317MN	1/24/96	4854	M85	15.52	0.17	0.1	1	278.19	260.89	259.99	310.39	1.194	0.845
AR317MN	10/30/96	18285	M85	16.25	0.21	0.1	0.05	278.64	260.09	259.14	315.64	1.218	0.851
AR319MN	1/3/97	9837	M85	17.34	0.22	0.1	1.2	331.16	314.86	313.96	372.59	1.187	0.935
AR320MN	2/27/96	6068	M85	12.78	0.19	0.1	1	242.67	227.27	226.57	292.68	1.292	0.719
AR320MN	11/4/96	14261	M85	15.1	0.18	0.2	1.2	285.68	268.98	268.28	328.88	1.226	0.932
			Count	8	8	8	8	8	8	8	8	8	8
			Average	15.648	0.200	0.113	0.919	275.233	257.939	257.108	319.498	1.248	0.861
			Std dev	1.578	0.026	0.035	0.374	27.968	27.902	27.862	25.509	0.083	0.079
			CV	0.101	0.131	0.314	0.407	0.102	0.108	0.108	0.080	0.066	0.092

Table C-2. 1995 FFV Dodge Intrepid: RFG Tests at Lab 1

Vehicle	Test date	Odometer	Fuel	HCHO	CH_3CHO	1,3-butadiene	benzene	VOC	NMOG	MIR	OFP	SR	Total Pwt
AR301MN	12/5/95	3549	RFG	2.24	0.58	0.9	4.9	188.22	157.62	150.82	561.54	3.723	1.155
AR302MN	2/16/96	5498	RFG	1.58	0.42	0.5	3.6	167.4	136.7	131.6	378.10	2.873	0.684
AR314GNC	12/11/96	12339	RFG	2.26	0.5	1.1	5.5	194.36	163.66	157.96	580.81	3.677	1.373
AR317MN	1/23/96	4827	RFG	1.84	0.48	0.6	3.9	140.72	112.12	107.02	406.73	3.8	0.805
AR317MN	10/29/96	18239	RFG	2.48	0.47	0.9	0.45	167.54	137.89	132.49	493.77	3.739	1.031
AR319MN	12/12/96	9764	RFG	2.13	0.52	0.9	4.4	158.25	134.05	129.45	484.49	3.743	1.134
AR320MN	2/26/96	6041	RFG	1.71	0.47	0.7	4.4	163.48	135.68	129.78	470.30	3.624	0.914
AR320MN	11/7/96	14341	RFG	1.77	0.46	0.9	4.5	162.83	140.33	135.73	477.81	3.52	1.120
			Count	8	8	8	8	8	8	8	8	8	8
			Average	2.001	0.488	0.813	3.956	167.850	139.756	134.356	481.692	3.587	1.027
			Std dev	0.319	0.047	0.196	1.530	16.863	15.660	15.276	68.504	0.301	0.219
			CV	0.159	0.097	0.241	0.387	0.100	0.112	0.114	0.142	0.084	0.213

Table C-3. 1995 Standard Dodge Intrepid: RFG Tests at Lab 1

Vehicle	Test date	Odometer	Fuel	HCHO	CH_3CHO	1,3-butadiene	benzene	VOC	NMOG	MIR	OFP	SR	Total Pwt
AR304GNC	7/12/95	3336	RFG	1.5	0.36	0.6	3.1	113.16	93.96	90.26	326.13	3.613	0.765
AR304GNC	8/6/96	14546	RFG	1.96	0.51	0.75	0.375	136.61	114.26	110.36	410.78	3.724	0.855
AR305GNC	6/21/95	3906	RFG	1.88	0.3	0.6	3.9	138.58	111.28	106.98	375.32	3.508	0.806
AR305GNC	9/26/96	15883	RFG	2.29	0.52	0.9	4.3	150.51	122.41	118.11	448.18	3.795	1.139
DT303GNC	9/4/96	12494	RFG	1.79	0.425	0.8	3.5	126.34	108.64	104.74	407.05	3.886	0.991
DT308GNC	11/21/95	5021	RFG	1.35	0.37	0.6	3.3	123.22	103.02	99.32	350.82	3.532	0.764
DT308GNC	9/3/96	13177	RFG	1.68	0.44	0.6	3.5	126.72	106.42	103.22	383.46	3.715	0.786
			Count	7	7	7	7	7	7	7	7	7	7
			Average	1.779	0.418	0.693	3.139	130.734	108.570	104.713	385.963	3.682	0.872
			Std dev	0.310	0.081	0.124	1.282	12.165	8.946	8.725	40.552	0.138	0.142
			CV	0.174	0.193	0.179	0.408	0.093	0.082	0.083	0.105	0.038	0.162

Table C-4. 1993 FFV Dodge Spirit: M85 Tests at Lab 1

Vehicle	Test date	Odomete	Fuel	HCHO	CH3CHO	1-3_but	benz	VOC	NMOG	MIR	OFP	SR	Total Pwt
AR206MS	11/21/94	6735	M85	9.28	0.17	0.1	1.3	187.85	177.25	176.9	221.52	1.252	0.567
DT219MS	6/13/94	17116	M85	13.67	0.32	0.1	1.5	206.69	190.69	189.59	273.49	1.443	0.776
DT219MS	6/22/95	29679	M85	17.29	0.23	0.1	1.4	233.02	217.02	216.02	323.53	1.498	0.939
DT221MS	5/3/94	11588	M85	12.54	0.2	0.1	0.9	167.64	156.24	155.94	228.29	1.464	0.705
DT221MS	3/16/95	22320	M85	12.69	0.2	0.1	1.1	231.69	220.59	219.39	280.98	1.281	0.718
DT226MSC	6/2/94	15299	M85	18.74	0.39	0.1	0.05	199.67	188.42	187.67	254.63	1.372	0.967
			Count	6	6	6	6	6	6	6	6	6	6
			Average	14.035	0.252	0.100	1.042	204.427	191.702	190.918	263.740	1.385	0.779
			Std dev	3.450	0.085	1.67E-09	0.531	25.364	24.305	23.971	37.655	0.101	0.152
			CV	0.246	0.338	1.67E-08	0.510	0.124	0.127	0.126	0.143	0.073	0.195

Table C-5. 1993 FFV Dodge Spirit: RFG Tests at Lab 1

Vehicle	Test date	Odometer	Fuel	HCHO	CH_3CHO	1,3-butadiene	benzene	VOC	NMOG	MIR	OFP	SR	Total Pwt
AR206MS	11/22/94	6769	RFG	1.23	0.39	0.8	4.7	110.22	94.52	91.72	364.76	3.977	1.001
DT219MS	6/1/94	16919	RFG	1.55	0.54	0.9	5	164.59	133.79	130.39	452.94	3.474	1.126
DT219MS	6/20/95	29653	RFG	2.01	0.45	0.9	4.8	233.02	217.02	216.02	323.53	1.498	1.140
DT221MS	4/28/94	11500	RFG	1.41	0.46	0.6	3.6	124.27	102.27	99.57	355.74	3.573	0.776
DT221MS	3/13/95	22279	RFG	1.29	0.39	0.7	3.9	231.69	220.59	219.39	280.98	1.281	0.879
DT226MSC	6/1/94	15257	RFG	2.63	0.7	0.9	4.4	172.53	142.63	138.63	505.82	3.649	1.159
			Count	6	6	6	6	6	6	6	6	6	6
			Average	1.687	0.488	0.800	4.400	172.720	151.80	149.29	380.63	2.909	1.013
			Std dev	0.540	0.118	0.126	0.548	51.833	55.006	55.900	83.622	1.191	0.157
			CV	0.320	0.241	0.158	0.124	0.300	0.362	0.374	0.220	0.409	0.155

Table C-6. 1993 Standard Dodge Spirit: RFG Tests at Lab 1

Vehicle	Test date	Odometer	Fuel	HCHO	CH_3CHO	1,3-butadiene	benzene	VOC	NMOG	MIR	OFP	SR	Total Pwt
DT214GSC	5/9/94	10632	RFG	1.39	0.43	0.3	0.1	59.23	51.18	49.98	165.09	3.304	0.370
DT214GSC	8/10/95	32278	RFG	1.86	0.33	0.4	2	91.29	78.89	75.39	261.09	3.463	0.548
DT221GSC	4/22/94	8994	RFG	1.23	0.4	0.3	2.6	75.43	63.53	62.03	193.43	3.118	0.438
DT221GSC	8/16/95	23507	RFG	1.47	0.32	0.3	3.7	112.09	90.49	86.59	265.74	3.069	0.481
DT225GSC	5/18/94	13037	RFG	1.34	0.34	0.4	3.2	92.78	76.88	75.08	223.5	2.977	0.560
DT225GSC	5/15/95	25452	RFG	1.29	0.31	0.5	3.1	104.7	86.4	83.2	265.45	3.191	0.655
			Count	6	6	6	6	6	6	6	6	6	6
			Average	1.430	0.355	0.367	2.450	89.253	74.562	72.045	229.05	3.187	0.509
			Std dev	0.226	0.048	0.082	1.288	19.335	14.740	13.737	42.634	0.175	0.100
			CV	0.158	0.137	0.223	0.526	0.217	0.198	0.191	0.186	0.055	0.198

Table C-7. 1993 FFV Dodge Spirit: M85 Tests at Lab 3

Vehicle	Test date	Odometer	Fuel	HCHO	CH3CHO	1-3_but	benz	VOC	NMOG	MIR	OFP	SR	Total Pwt
DV205MS	10/18/95	20922	M85	11.5	0.5	0.2	1.9	255.1	234.6	233.23	340.83	1.461	0.79
DV206MS	12/5/95	15864	M85	9.7	0.3	0.2	1.6	263.87	248.97	247.29	344.97	1.395	0.697
DV207MS	10/3/95	26750	M85	12.1	0.3	0.1	2	336.97	316.77	315.14	424.44	1.347	0.719
DV242MS	2/8/95	8746	M85	6.9	0.1	0.1	1	179.7	166.3	165.03	234.85	1.423	0.448
DV242MS	2/27/96	11346	M85	9	0.2	0.288	1.86	306.59	286.219	283.461	370.28	1.306	0.759
DV248MS	11/7/95	18349	M85	9.4	0.3	0.2	2.2	263.59	243.09	241.61	326.30	1.351	0.701
DV249MS	2/2/95	13241	M85	7.3	0.2	0.1	1.5	201.72	185.42	184.7	263.41	1.426	0.482
DV249MS	11/28/95	20873	M85	11.9	0.3	0.2	1.5	277.98	259.08	257.31	356.22	1.384	0.795
			Count	8	8	8	8	8	8	8	8	8	8
			Average	9.725	0.275	0.174	1.695	260.691	242.556	240.971	332.661	1.387	0.674
			Std dev	2.001	0.116	0.068	0.375	51.146	49.094	48.708	59.779	0.051	0.134
			CV	0.206	0.424	0.390	0.221	0.196	0.202	0.202	0.180	0.036	0.199

Table C-8. 1993 FFV Dodge Spirit: RFG Tests at Lab 3

Vehicle	Test date	Odometer	Fuel	HCHO	CH_3CHO	1,3-butadiene	benzene	VOC	NMOG	MIR	OFP	SR	Total Pwt
DV205MS	10/17/95	20896	RFG	2.8	0.8	1.4	11.8	490.13	437.13	424.5	1387.13	3.268	1.889
DV206MS	12/7/95	15895	RFG	1.1	0.4	0.6	3.2	136.77	113.97	111.04	417.25	3.758	0.750
DV207MS	10/4/95	26776	RFG	1.7	0.6	1.3	7.9	289.08	242.48	235.65	862.35	3.659	1.620
DV242MS	2/10/95	8791	RFG	1.1	0.2	0.8	4.3	171.4	150.3	145.77	524.22	3.596	0.981
DV242MS	2/28/96	11372	RFG	1.2	0.4	1.077	4.684	209.29	181.48	175.63	651.96	3.712	1.276
DV248MS	11/8/95	18375	RFG	1.4	0.5	1	5	207.93	177.23	172.31	601.48	3.491	1.218
DV249MS	2/1/95	13207	RFG	1	0.3	1	5	211.87	183.97	176.65	650.36	3.682	1.198
DV249MS	11/29/95	20900	RFG	2	0.6	0.8	6.3	302.37	266.87	258.34	898.81	3.479	1.086
			Count	8	8	8	8	8	8	8	8	8	8
			Average	1.538	0.475	0.997	6.023	252.356	219.179	212.487	749.195	3.581	1.252
			Std dev	0.614	0.191	0.266	2.720	110.691	100.395	97.532	303.314	0.161	0.358
			CV	0.399	0.402	0.267	0.452	0.439	0.458	0.459	0.405	0.045	0.286

Table C-9. 1993 Standard Dodge Spirit: RFG Tests at Lab 3

Vehicle	Test	Odometer	Fuel	HCHO	CH_3CHO	1,3-butadiene	benzene	VOC	NMOG	MIR	OFP	SR	Total Pwt
DV204GSC	2/13/96	28431	RFG	1.1	0.3	0.229	2.15	100.68	86.252	83.208	277.27	3.332	0.347
DV212GSC	2/23/95	9467	RFG	0.7	0.1	0.3	1.8	86.27	74.77	72.54	223.95	3.087	0.387
DV212GSC	1/31/96	13560	RFG	1	0.3	0.192	2.758	108.76	88.761	85.711	270.98	3.162	0.323
DV213GSC	10/6/95	34397	RFG	1.6	0.4	0.3	2.6	109.68	97.08	95.06	296.41	3.118	0.455
DV222GSC	2/15/96	16295	RFG	0.8	0.3	0.185	1.775	85.83	74.616	72.272	224.00	3.099	0.277
DV225GSC	10/11/95	30953	RFG	1.1	0.5	0.2	2.3	113.02	100.42	98.89	291.70	2.950	0.324
DV226GSC	2/15/95	9051	RFG	0.5	0.1	0.2	2.3	86.94	75.44	74.12	246.22	3.322	0.293
DV226GSC	2/20/96	13090	RFG	0.9	0.2	0.236	1.786	84.25	73.031	71.069	221.50	3.117	0.333
			Count	8	8	8	8	8	8	8	8	8	8
			Average	0.963	0.275	0.230	2.184	96.928	83.796	81.609	256.505	3.148	0.342
			Std dev	0.329	0.139	0.046	0.379	12.381	10.922	10.925	31.440	0.126	0.056
			CV	0.342	0.505	0.202	0.173	0.128	0.130	0.134	0.123	0.040	0.164

Table C-10. 1994/95 FFV Ford Taurus: E85 Tests at Lab 1

Vehicle	Test_dat	Odometer	Fuel	HCHO	CH_3CHO	1,3-butadiene	benzene	VOC	NMOG	MIR	OFP	SR	Total Pwt
AR317ET	11/11/96	8211	E85	2	10.25	0.2	1.1	195.94	166.34	165.84	372.92	2.249	0.407
AR318ET	5/15/95	3077	E85	2.09	9.34	0.1	1	148.03	129.23	128.63	271.91	2.114	0.301
AR318ET	10/16/96	11104	E85	2.26	9.71	0.2	1.3	220.86	199.36	198.46	426.05	2.147	0.421
AR320ET	11/15/96	9713	E85	1.73	9.24	0.1	1.1	190.99	163.39	162.79	356.21	2.188	0.287
AR325ET	9/13/95	3406	E85	2.26	7.83	0.2	1	149.59	125.09	124.59	288.84	2.318	0.397
AR325ET	8/29/96	15178	E85	2.55	13.2	0.2	0.1	243.82	215.52	214.37	473.36	2.209	0.426
AR326ET	10/6/95	17016	E85	2.81	8.83	0.2	1	177.54	145.34	144.54	343.14	2.374	0.430
AR334ET	10/17/95	9133	E85	2.08	10.43	0.2	1.5	264.91	231.51	230.21	488.22	2.121	0.424
			Count	8	8	8	8	8	8	8	8	8	8
			Average	2.223	9.854	0.175	1.013	198.960	171.973	171.179	377.581	2.215	0.386
			Std dev	0.335	1.581	0.046	0.409	42.095	39.697	39.431	79.705	0.094	0.058
			CV	0.151	0.160	0.265	0.404	0.212	0.231	0.230	0.211	0.042	0.151

Table C-11. 1994/95 FFV Ford Taurus: RFG Tests at Lab 1

Vehicle	Test	Odometer	Fuel	HCHO	CH_3CHO	1,3-butadiene	benzene	VOC	NMOG	MIR	OFP	SR	Total Pwt
AR317ET	11/20/96	8355	RFG	1.1	0.28	0.6	2.6	95.63	83.53	80.93	300.19	3.709	0.731
AR318ET	5/12/95	3051	RFG	1.06	0.22	0.5	2.6	88.78	80.38	77.28	271.96	3.519	0.629
AR318ET	10/10/96	11042	RFG	1.24	0.31	0.6	3.5	120.09	107.59	103.99	370.17	3.56	0.765
AR320ET	11/12/96	9645	RFG	0.95	0.19	0.6	2.9	104.52	92.02	89.12	316.62	3.553	0.732
AR325ET	9/14/95	3432	RFG	1.31	0.29	0.5	2.4	87.9	77.4	74.8	271.16	3.625	0.635
AR325ET	8/14/96	15012	RFG	1.4	0.38	0.55	3.4	119.04	105.59	101.99	369.74	3.632	0.719
AR326ET	10/5/95	16990	RFG	2.23	0.34	0.6	2.9	124.07	108.97	105.17	362.43	3.446	0.792
AR334ET	10/13/95	9107	RFG	1.11	0.19	0.4	2.6	94.2	82.9	79.6	282.23	3.546	0.531
			Count	8	8	8	8	8	8	8	8	8	8
			Average	1.300	0.275	0.544	2.863	104.279	92.298	89.110	318.062	3.574	0.692
			Std dev	0.403	0.070	0.073	0.400	14.854	13.190	12.802	43.564	0.080	0.087
			CV	0.310	0.254	0.134	0.140	0.142	0.143	0.144	0.137	0.022	0.125

Table C-12. 1995 Standard Ford Taurus: RFG Tests at Lab 1

Vehicle	Test	Odometer	Fuel	HCHO	CH_3CHO	1,3-butadiene	benzene	VOC	NMOG	MIR	OFP	SR	Total Pwt
AR304GTC	7/11/95	3027	RFG	0.99	0.23	0.7	2.5	75.22	65.02	62.82	257.67	4.102	0.822
AR304GTC	8/5/96	25175	RFG	0.92	0.028	0.4	3.1	100.9	86.1	83.1	294.61	3.545	0.536
AR308GTC	12/13/95	4884	RFG	0.78	0.25	0.5	3.7	109.83	97.03	93.23	322.75	3.462	0.649
DT301GTC	8/11/95	3403	RFG	1	0.29	0.5	3.1	86.89	77.19	74.19	280.15	3.776	0.641
DT301GTC	9/3/96	15635	RFG	0.94	0.26	0.6	0.3	96.17	82.72	80.42	301.75	3.764	0.654
DT305GTC	10/25/95	4060	RFG	0.98	0.24	0.7	2.9	91.52	81.72	78.82	288.00	3.654	0.834
DT305GTC	9/10/96	12226	RFG	0.83	0.19	0.6	3.2	99.22	87.82	84.62	309.54	3.658	0.736
DT306GTC	9/6/96	12053	RFG	0.86	0.22	0.6	3.5	94.48	82.38	79.78	293.19	3.675	0.746
			Count	8	8	8	8	8	8	8	8	8	8
			Average	0.913	0.214	0.575	2.788	94.279	82.498	79.623	293.457	3.705	0.702
			Std dev	0.081	0.080	0.104	1.068	10.276	9.156	8.745	19.547	0.191	0.101
			CV	0.089	0.377	0.180	0.383	0.109	0.111	0.110	0.067	0.052	0.144

Table C-13. 1992/94 CNG Dodge B250 Van: CNG Tests at Lab 1

Vehicle	Test	Odometer	Fuel	HCHO	CH_3CHO	1,3-butadiene	benzene	VOC	NMOG	MIR	OFP	SR	Total Pwt
OH301CR	8/2/95	5508	CNG	1.860	0.150	0	0.1	384.51	19.11	19.01	40.361	2.123	0.090
OH301CR	1/15/97	13434	CNG	2.120	0.160	0	0	321.38	22.48	22.48	47.237	2.101	0.099
OH305CR	12/10/96	11503	CNG	2.540	0.210	0	0	488.07	30.17	30.17	69.66	2.31	0.119
OH305CR	12/2/96	11457	CNG	2.320	0.150	0	0.2	329.15	24.05	24.05	60.726	2.525	0.114
Average				2.430	0.180	0	0.1	408.61	27.11	27.11	65.193	2.4175	0.116
OH307CR	12/10/96	9014	CNG	1.440	0.160	0	0	224.7	16.3	16.3	33.54	2.058	0.068
OH308CR	1/28/97	12246	CNG	1.540	0.110	0	0.1	328.65	24.75	24.75	39.683	1.6034	0.075
			Count	5	5		5	5	5	5	5	5	5
			Average	1.878	0.152		0.060	333.570	21.950	21.930	45.203	2.061	0.089
			Std dev	0.409	0.026		0.055	71.154	4.322	4.339	12.183	0.292	0.019
			CV	0.218	0.170		0.913	0.213	0.197	0.198	0.270	0.142	0.217

Table C-14. 1992 Standard Dodge B250 Van: RFG Tests at Lab 1

Vehicle	Test	Odometer	Fuel	HCHO	CH_3CHO	1,3-butadiene	benzene	VOC	NMOG	MIR	OFP	SR	Total Pwt
AR301GRC	8/15/95	36218	RFG	6.120	1.110	2.0	12.4	385.63	313.93	300.43	1177.30	3.9187	2.662
AR301GRC	8/28/97	60261	RFG	4.900	1.100	2.0	14.7	455.00	367.50	353.00	1207.66	3.421	2.675
DT303GRC	9/21/95	34217	RFG	5.660	0.950	1.9	11.0	351.21	280.81	270.81	1063.27	3.926	2.498
DT303GRC	1/31/97	51772	RFG	5.920	1.340	2.6	17.0	520.28	429.68	414.28	1642.58	3.965	3.393
DT303GRC	1/24/97	51733	RFG	7.130	1.550	2.4	18.1	492.86	410.86	396.86	1556.16	3.921	3.283
Average				6.525	1.445	2.5	17.55	506.57	420.27	405.57	1599.37	3.943	3.338
DT304GRC	10/10/97	40152	RFG	5.500	1.230	2.1	15.1	466.93	389.93	372.33	1478.97	3.972	2.816
			Count	5	5	5	5	5	5	5	5	5	5
			Average	5.741	1.167	2.100	14.15	433.07	354.49	340.43	1305.31	3.836	2.798
			Std dev	0.619	0.184	0.235	2.537	63.209	56.626	54.465	224.238	0.233	0.322
			CV	0.108	0.158	0.112	0.179	0.146	0.160	0.160	0.172	0.061	0.115

Table C-15. 1992/94 CNG Dodge B250 Van: CNG Tests at Lab 3

Vehicle	Test	Odometer	Fuel	HCHO	CH_3CHO	1,3-butadiene	benzene	VOC	NMOG	MIR	OFP	SR	Total Pwt
DV204CR	2/16/95	5271	CNG	10.80	0.70	0.2	1.1	1796.56	204.16	203.61	487.52	2.394	0.735
DV204CR	1/5/96	6857	CNG	18.30	1.60	0.2	1	1900.9	218.90	217.24	566.63	2.608	1.085
DV204CR	9/25/96	9257	CNG	18.40	1.30	0.432	1.307	1867.25	225.99	223.98	603.64	2.695	1.328
DV205CR	8/17/95	22821	CNG	1.10	0.10	0	0.3	1034.87	41.57	41.05	60.75	1.480	0.060
DV205CR	9/12/96	45147	CNG	2.10	0.20	0	0.311	1065.37	55.96	54.76	92.98	1.698	0.108
DV212CR	3/1/95	9514	CNG	1.80	0.10	0	0.3	725.54	61.44	59.71	100.58	1.684	0.093
DV212CR	3/12/96	13753	CNG	2.40	0.20	0.056	0.42	848.31	52.79	50.69	87.27	1.722	0.181
DV212CR	10/31/96	16705	CNG	3.10	0.20	0	0.257	3296.01	109.17	108.24	112.90	1.043	0.152
DV212CR	11/1/96	16731	CNG	3.00	0.20	0	0.149	3921.64	204.70	203.53	135.08	0.664	0.144
Average				3.05	0.20	0	0.203	3608.83	156.94	155.89	123.99	0.853	0.148
DV217CR	8/22/95	13004	CNG	1.80	0.20	0	0.1	978.74	109.44	108.58	138.08	1.272	0.087
DV217CR	9/18/96	21647	CNG	1.80	0.20	0.04	0.117	1200.27	57.20	55.83	71.25	1.276	0.128
			Count	7	7	7	7	7	7	7	7	7	7
			Average	2.007	0.171	0.014	0.250	1351.70	76.48	75.22	96.42	1.426	0.115
			Std dev	0.606	0.049	0.024	0.115	1007.02	41.55	41.682	27.428	0.318	0.041
			CV	0.302	0.285	1.741	0.462	0.745	0.543	0.554	0.284	0.223	0.353

Table C-16. 1992 Standard Dodge B250 Van: RFG Tests at Lab 3

Vehicle	Test	Odometer	Fuel	HCHO	CH_3CHO	1,3-butadiene	benzene	VOC	NMOG	MIR	OFP	SR	Total Pwt
DV209GRC	4/18/95	10123	RFG	0.1702	0.008	1.90	10.10	325.61	282.61	274.39	1102.12	4.017	2.381
DV209GRC	9/24/96	15482	RFG	0.161	0.008	2.103	12.302	354.083	297.728	289.33	1158.44	4.004	2.641
DV209GRC	9/26/96	15508	RFG	0.1702	0.008	1.589	12.373	351.19	299.999	292.04	1135.27	3.887	2.138
Average				0.1656	0.008	1.846	12.338	352.637	298.864	290.68	1146.85	3.946	2.390
DV213GRC	4/25/95	9300	RFG	0.1794	0.0112	1.90	11.30	403.15	291.25	281.10	1181.48	4.203	2.430
DV214GRC	4/27/95	7287	RFG	0.1058	0.0048	2.00	9.50	345.12	299.42	290.45	1164.62	4.010	2.396
DV214GRC	9/17/96	10361	RFG	0.1886	0.0096	2.231	13.087	399.445	345.673	336.86	1340.67	3.980	2.822
DV215GRC	8/24/95	11392	RFG	0.1288	0.0056	1.80	10.30	375.69	319.59	309.58	1270.01	4.102	2.243
DV215GRC	10/15/96	17452	RFG	0.1932	0.0088	1.743	9.326	349.045	295.312	286.96	1181.32	4.117	2.225
DV222GRC	8/29/95	20957	RFG	0.138	0.008	2.20	12.00	367.46	309.46	301.61	1172.66	3.888	2.706
DV222GRC	9/4/96	24940	RFG	0.1656	0.0072	2.249	12.656	393.586	336.325	328.57	1320.60	4.019	2.801
			Count	9	9	9	9	9	9	9	9	9	9
			Average	0.159	0.008	1.985	11.179	367.971	308.723	300.022	1208.927	4.031	2.488
			Std dev	0.029	0.002	0.195	1.416	27.051	21.203	21.301	81.864	0.096	0.229
			CV	0.184	0.245	0.098	0.127	0.074	0.069	0.071	0.068	0.024	0.092

Appendix D:
Emissions Data Compilation, Editing, and Reduction
and
the Analysis of Variance Approach to Statistical Treatment of Emissions Data

Raw data files of the emissions tests from each laboratory were submitted electronically and then loaded into the Alternative Fuels Data Center at NREL. Before any data analysis was conducted, checks and edits were undertaken to ensure data quality. In particular, the data were reviewed for the presence of outliers. To begin this review process, the data sets were sorted by vehicle type, test fuel, and test round. At the first level of data quality checks, the replicate test results were evaluated. An initial set of replicate tests was conducted on some vehicles to provide information about test repeatability. Additional replicated tests were performed on vehicles that exceeded the EPA emissions certification standards. A comparison of the replicate results helped to identify some individual test results as outliers. These results were then eliminated from further consideration (although, as described below, the established outlier detection procedure involved more than these replicate test results).

The four-stage procedure outlined below was used to identify and eliminate outliers in the exhaust emissions test results, and to compile the final data sets for statistical analysis. No evaporative emissions results were removed from the data sets because of the high level of variability in typical evaporative emissions.

1. Stage One (Replicate Analysis)—For each emissions constituent (e.g., NO_x), all pairs of replicated test results were first considered. The absolute value of the difference between each pair was computed, and the mean and standard deviation of all such differences were also computed. Individual differences outside a bound equal to the mean plus three standard deviations were flagged as excessive. The two test results from each of the flagged pairs were then reviewed, and the one result in each pair furthest from the overall mean was designated as an outlier and eliminated. For all other pairs (those not flagged as excessive), the two test results were simply averaged to produce a single result. In this manner, the overall data set was reduced to a single value per vehicle type/fuel/test round for each emissions constituent.

2. Stage Two (Among-Vehicle Data Quality Checks)—Having a single set of values for each vehicle type/fuel/test round, it was then necessary to compare the results for each combination of the three (e.g., Dodge Spirit, M85, round 1). Consequently, for every vehicle type/fuel/test round combination, the mean and the standard deviation of each emissions constituent were computed. Individual vehicle values outside a bound of the mean plus or minus three standard deviations were designated as outliers and removed from further consideration.

3. Stage Three (Checks Among Emissions Constituents, or Total Vehicle Viability)—Depending on the emissions constituent in question, the application of the edits performed in Stage Two left a number of "holes" in the data. In some cases, the process resulted in multiple holes (more than one emissions constituent missing) for a given test. Because each hole is the result of an emissions test value being designated as an outlier, tests (for a given fuel/test round combination) having two or more holes on major emissions constituents (HC, NO_x, and CO) were deemed to be "not viable" and were completely eliminated from further consideration.

4. Stage Four (Data Reduction for Multiple Rounds)—Finally, for purposes of this particular report, only the results on vehicles tested in all rounds (for a particular model/fuel combination) were retained for data analysis purposes (Note: some vehicles were not tested in all rounds for a number of reasons. For example, some failed the pre-test maintenance checks and were returned to the agencies, and some were retired from service by GSA before all rounds of testing could be completed).

Analysis of variance (ANOVA) was the principal statistical technique used to analyze the emissions data presented in this report. Whereas the t-test—one of the most frequently applied statistical procedures—is used to assess the significance of differences in pairs of mean values, ANOVA facilitates simultaneous assessment of multiple differences among a collection of two or more means (see, for example, Table D-1).

Table D-1. Example Table of Mean Values

	Round 1	Round 2	Round 3
Fuel 1	$\bar{x}_{11}$	$\bar{x}_{12}$	$\bar{x}_{13}$
Fuel 2	$\bar{x}_{21}$	$\bar{x}_{22}$	$\bar{x}_{23}$

Note: See below for explanation of "fuel" and "round." $\bar{x}$ stands for the mean value of some emissions constituent of interest (e.g., CO). $\bar{x}_{11} - \bar{x}_{23}$ is an example of one possible difference in mean values.

ANOVA is even more useful in that it allows the total variation in a set of data (as measured by the sum of squared deviations from a mean value) to be subdivided into the portions that are attributable to various experimental or observational factors. In this manner, the contributions of various factors to the observed variability in some test result, laboratory response, or property of interest, can be identified and quantified, along with the effects of such factors interacting among themselves.

In the context of the emissions testing program discussed in this report, the experimental factors assumed to generate differences in test results are: (1) fuel (alternative fuel versus gasoline); (2) round (a proxy for mileage); (3) laboratory (three different laboratories chosen through competitive bidding and employing the same test procedures; one of the three at high altitude); and (4) vehicle model (Dodge Caravan, Chevy Lumina, etc.). In addition, differences among individual vehicles of the same model contribute to the total variation in emissions test results, with random sampling resulting in such differences. Although other factors may affect variability in emissions, these are not explicitly controlled in the test program. Contributions to the total variation from these factors cannot be determined.

The arithmetic computations of analysis of variance, which are explained in textbooks on statistical methods, are usually summarized in a tabular form like the one shown in Table D-2. The first column in the table identifies the experimental factors, or sources of variation, while the second lists the corresponding numbers associated with a quantity called the "degrees of freedom." Typically, the degrees of freedom associated with a particular factor consist of the number of "levels" of that factor minus one (or in the case of the category labeled "Total," the overall number of observations or test results minus one).

Table D-2. General Form of an ANOVA Table

Source	Degrees of Freedom	Sums of Squares	Mean Squares	F-Value	Significance Level
Total	n-1	*			
Factor A	a - 1	*	*	*	*
Factor B	b-1	*	*	*	*
. . .	. . .	*	*	*	*
Factor Z	z-1	*	*	*	*
Remainder[1]	(n-1)-(a-1)-(b-1)-…-(z-1)	*	*		

*Values to be computed.

[1]In many cases, "Remainder" is denoted as "Error," which, depending on the context of the analysis, can be either experimental error or sampling error.

Note: n is the total number of observations; a is the number of levels of Factor A, b is the number of levels of Factor B, etc.

The third column lists a series of intermediate calculations, referred to as "sums of squares," which are associated with the respective factors or sources of variation. "Sums of squares" is abbreviated wording for "sum of squared deviations from the mean," which is the basic calculation needed for computing a statistical variance. The sums of squares associated with the different factors in Table D-2 below the "Total" line must, of necessity, add up to the sum of squares shown on the "Total" line (this is the additive property of ANOVA).

The fourth column in Table D-2 lists a series of numbers referred to as the "mean squares." The mean squares associated with the respective factors or sources of variation are computed by dividing the corresponding sum of squares by the corresponding degrees of freedom. It is these mean squares that are actual variances.

The fifth column in the table contains a series of numbers under the heading of "F-Value." These numbers are determined by taking ratios of the mean squares associated with various factors. The numbers in this column are referred to as F-values because they adhere to a special probability distribution called the F-distribution.

The sixth and final column in the table lists probability values that can be used to assess the size of the corresponding F-values (or ratios of "mean squares"). These are often referred to as "Significance Levels."

Typical ANOVA tables based on some of the data presented in this report is shown in Tables D-3 and D-4.

Once the experimental factors, or sources of variation, have been accurately identified, the calculations necessary to complete an ANOVA table are relatively straightforward. Software products such as JMP, available from SAS Institute, make it possible to avoid the algebraic tedium that would otherwise be required to compute all the numbers. Interpreting the results is quite a different matter. To make an appropriate interpretation, we must consider the population of units to which statistical inferences are to be drawn. In addition, we must determine which factors are to be regarded as "fixed" and which are "random."

Table D-3. ANOVA in CO Measurements Obtained in Emissions Tests on Flexible-Fuel Dodge Intrepids

Source	Degrees of Freedom	Sums of Squares	Mean Squares	F-Value	Significance Level[4]
Total	59	1.5431			
Rounds	1	0.2926	0.2926	10.1715	0.0066
Fuels	1	0.0150	0.0150	1.1894	0.2939

Round x Fuel[1]	1	0.0023	0.0023	0.2306	0.6385
Vehicles	14	0.5149	0.0368	1.1669	0.3941
Vehicle x Round[2]	14	0.4027	0.0288	2.9077	0.0275
Vehicle x Fuel[3]	14	0.1771	0.0127	1.2783	0.3261
Error	14	0.1385	0.0099		

[1,2,3]Factor interaction terms

[4]Values of .05 or less would ordinarily indicate significant differences. For example, the significance level of 0.0066 associated with the F-value for "Rounds" indicates that the same average value of CO was not obtained in both test rounds.

Table D-4. ANOVA in NO_x Measurements Obtained in Emissions Tests on Flexible-Fuel Dodge Spirits

Source	Degrees of Freedom	Sums of Squares	Mean Squares	F-Value	Significance Level[4]
Total	83	1.2592			
Rounds	1	0.0074	0.0074	0.4901	0.4920
Fuels	1	0.0031	0.0031	0.2444	0.6264
Round x Fuel[1]	1	0.0500	0.0500	17.5905	0.0004
Vehicles	20	0.5851	0.0293	1.1708	0.3381
Vehicle x Round[2]	20	0.3032	0.0152	5.3304	0.0002
Vehicle x Fuel[3]	20	0.2534	0.0127	4.4551	0.0008
Error	20	0.0569	0.0028		

[1,2,3]Factor interaction terms

[4]Values of .05 or less would ordinarily indicate significant differences. For example, the significance level of 0.0004 associated with the F-value for the "Round x Fuel" interaction indicates that the difference in the average values of NO_x for the two fuels was not the same from one test round to the next.

Fixed factors are those whose range of values, or levels, are completely encompassed by the specific population units included in the investigation. In the context of the this emissions testing study, "fuel" is a fixed experimental factor because there is not interest in, nor rationale for, drawing conclusions about fuels other than those being specifically studied. A random factor, on the other hand, is one about which conclusions can be extended to a larger collection of units than the ones specifically included in the investigation. In this context, "vehicle" is a random factor because individual vehicles were randomly selected from a larger collection, or population, and projecting the results of the testing program to that larger population is desirable. The determination of fixed and random factors governs the way the F-values are computed (that is, the choice of numerator and denominator in the ratio of mean squares; the denominator always represents an "error" term against which the numerator is compared) and directly affects interpretation of the results. The bigger the F-value, the more likely at least one difference among the means being compared is statistically significant.

ANOVA's statistical procedure is constructed on certain mathematical assumptions. The first assumption—that effects of the various experimental factors are additive—has already been mentioned (in the sense that the individual sums of squares add up to the total). The second assumption is that all experimental errors are random, independent, and follow a normal (Gaussian, or bell-shaped) distribution. Violating either of these assumptions will negate the interpretability of the results.

Statistical software packages such as JMP provide many other capabilities that extend and build on the information derived from the basic ANOVA. In particular, it is possible to estimate the actual components of variance attributable to each experimental factor, and to adjust mean values for unequal numbers of observations using a least squares approach. The details of these techniques are beyond the scope of this discussion.

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In support of the U.S. Department of Energy's development and deployment of alternative fuels for environmental and national security reasons, NREL has managed a series of light-duty vehicle emissions tests on alternative fuel vehicles (AFVs). The purpose of this report is to give a detailed evaluation of the final emissions test results on vehicles tested on methanol, ethanol, and compressed natural gas.

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